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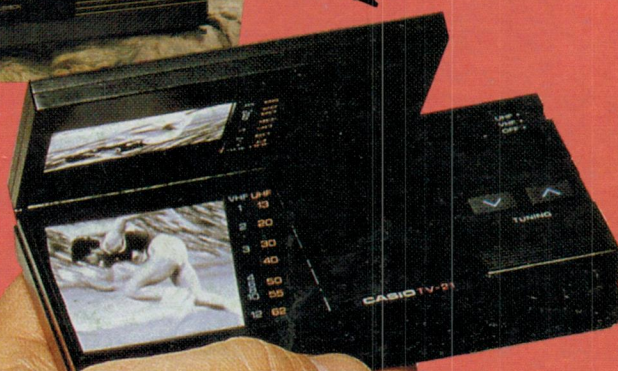
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AUGUST 1985

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**TRANSCEIVER REVIEWS**

**HOW GOOD IS YOUR  
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**STARTING ELECTRONICS  
GETTING STARTED ON HF**

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# TOP CATS OF THE HI-FI JUNGLE

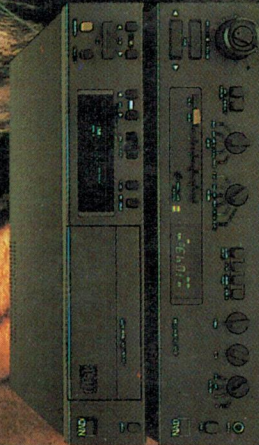


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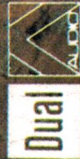
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Mary Rennie  
Jon Fairall B.A.  
Geoff Nicholls B.Sc./B.E.  
Robert Irwin B.E.  
S. K. Hui B.Sc. (Hons)

**DRAUGHTING**  
David Burrows

**ART DIRECTOR**  
Vicki Jones

**ADVERTISING PRODUCTION**  
Danny Hooper

**ADVERTISING MANAGER**  
Mel Godfrey

**READER SERVICES**  
Elizabeth Barnett  
Felicity Skinner

**ACOUSTICAL CONSULTANTS**  
Louis Challis and Associates

**MANAGING EDITOR**  
Jamieson Rowe

**PUBLISHER**  
Michael Hannan

**HEAD OFFICE**  
140 Joynton Avenue, (PO Box 227)  
Waterloo, NSW 2017.  
Phone: (02) 663-9999 Sydney.  
Telex: 74488, FEDPUB.  
Federal Facsimile: 663-5144.

**ADVERTISING OFFICES  
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**New South Wales:** Peter Hayes and Peter  
Kilby, The Federal Publishing Company,  
140 Joynton Avenue, Waterloo.

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The Federal Publishing Company, 23rd  
Floor, 150 Lonsdale Street, Melbourne, Vic.  
3000. Phone: (03) 662-1222 Melbourne.  
Telex: 34340, FEDPUB.

**South Australia and Northern Territory:**  
Steve Birbeck, The Admedia Group, 24  
Kensington Road, Rose Park, SA 5067.  
Phone: (08) 332-8144 Adelaide. Telex:  
82182, ADMEDIA.

**Queensland:** John Perry, The Federal  
Publishing Company, 25 Balaclava Street,  
Woolloongabba, Qld. 4102. Phone: (07)  
391-8922. Telex: AA145520.

**Western Australia:** Tony Allen &  
Associates, 7 Fore St, Perth, WA 6000.  
Phone: (09) 328-9833.

**New Zealand:** Chris Horsley, 4A Symonds  
Court, Symonds Street, Auckland. Telex:  
NZ60753, TEXTURE. Phone: 39-6096.  
Auckland.

**Britain:** Peter Holloway, John Fairfax and  
Sons (Australia) Ltd, Associated Press  
House, 12 Norwich Street, London EC4A  
1BH. Phone: (01) 353-9321 London. Telex:  
262836, SMHLDN.

**Japan:** Genzo Uchida, Bancho Media  
Services, 5th Floor, Dai-Ichi Nisawa  
Building, 3-1 Kanda Tacho 2-chome,  
Chiyoda-ku, Tokyo 101. Phone: (03)  
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# Electronics Today

AUGUST  
1985

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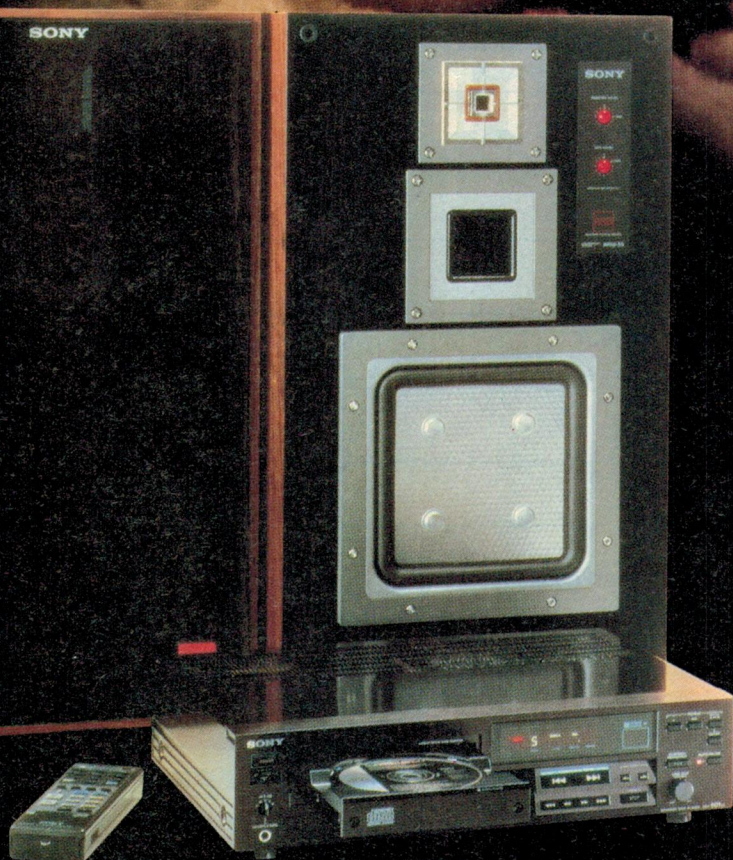
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**COVER:** Concept and design by Vicki Jones.

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A FEW YEARS AGO signal processing was quite a hot issue among radio and television broadcasters. Today processing is so endemic that viewers and listeners are denied even the mediocre resolution and clarity of their receivers.

Broadcasters complain of short shrift by receiver makers. They say they are being asked to broadcast a signal that is significantly better than can be passed by radio and television receivers. But the processing activities of the broadcasters put their arguments on shaky ground.

At the introduction of commercial FM in Australia the tyro broadcasters thumbed their noses at the AMers. They would maintain clarity and would not process audio the way the AM stations do. Well the honeymoon didn't last long did it!

Now it's video's turn. It started with cameras used outside the studios (OB cameras) and has now found its way into the studio. You'll notice it most on the faces in front of the camera — the faces seem to be made up of flat patches of colour, there's no detail and no deep shadows. Not all stations are doing it but the trend is increasing.

The reason is that programme producers have discovered cameras, mainly from Japan, that provide an array of video processing features.

In the field, operators of OB cameras can't always adapt the lighting conditions to suit the camera and a manual camera control unit is too cumbersome to cart around.

Along with the usual automatic level controls these cameras will dynamically adjust the picture brightness along each picture line. The idea is to get rid of the black shadows created by grandstands at sports grounds and other buildings.

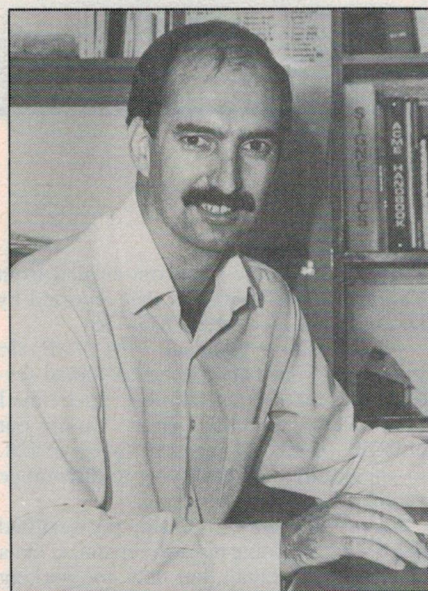
It makes life so simple, especially if you adapt the technique for the studio — no need for skilled lighting people who know how to create a picture with pleasing shadows and interesting highlights.

It looks as though the future of television broadcasting is about as interesting as rice pudding.

Who needs all that television bandwidth anyway? Who needs any picture resolution at all, let alone high definition television?

On one hand we are being promised more resolution and on the other it is being taken away.

David Kelly  
Editor



## NEXT MONTH

### CONTINUITY TESTER

A cheap simple project to help you build that handiest of devices to check continuity. The continuity tester solves the problem of probes slipping off leads when you turn to check the meter and is particularly useful for working on car circuits.

### AM STEREO REVIEW

A big step forward for AM stereo reception is a big step forward for the motorist! Louis Challis has tested a car AM stereo and found it ranks among the best. Worth comparing with an expensive home receiver.

### THE DIMINISHING CAPACITOR

In size anyway. This feature article looks at the history of capacitors from Leydon jars to today's polystyrene. More and more capacitance is being packed into smaller sizes, just a little intriguing.

### CLIVE SINCLAIR

Launched the ZX80 computer way back when and started to make money in a big way. What's happened since? Well there have been a few struggles, a few flops and some pretty ambitious designs.

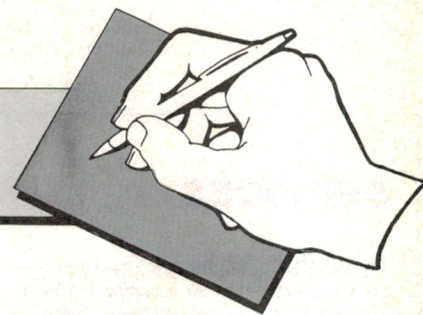
### STARTING ELECTRONICS

On with the show! In episode 7, the meter's movement is revealed, and the cable's story comes out. But what's behind the indicator lamp, and can the battery keep its secret? Be watching.

### BONUS HI-FI REVIEW ISSUE

A 40-page lift-out of the best Louis Challis hi-fi reviews: what is good and why. This bonus issue tells you what to look for, explains the jargon and as well reviews the best.

# Letters to the Editor



## Consumer rights I

I HAVE HAD the same run around from National in Melbourne as that reported by David Hynds (see letters May '85).

I purchased a National 777A VCR 2½ years ago. I have approached National several times for a service manual. Each time I have received excuses such as "we are out of stock". I was also quoted a price of \$28, so apparently they are trying to discourage people from asking for them.

I consider this a ploy to stop the qualified hobbyist from doing his own repairs. (I am a qualified serviceman, but now not working in my trade.) My reason for wanting this manual now is that I want to get hold of one while it is still available. I have been caught before!

It's a pity the trade practices act can't be used against National for restrictive practices or something similar. My VCR has given me no trouble, but in future I shall only be purchasing gear that has freely available service data.

National's policy deserves the strongest possible condemnation.

**DL Gamble,  
Sunbury, Vic**

## Kit woes

YOUR READERS should be made aware that not all kit sets comprise components listed within the parts list detailed in projects published in the magazines *Electronics Australia* and *Electronics Today International*. I have reason to believe that substitute parts may sometimes be inferior to those nominated and have proof of one such occurrence.

To elaborate, a transformer was returned to Ferguson Transformers Pty Ltd by an electronic retailer with a letter from the end user detailing faults and expressing dissatisfaction with the product. The transformer, purported to be PF4361/1, was found to be a very poor substitute for the reasons that:

- 1) the windings are side by side and not close coupled. It is estimated that this must degrade the regulation from 4% to approximately 6%;
- 2) the bobbin is not properly wedged, causing noise;
- 3) the transformer was inadequately impregnated which compounds the problem;
- 4) the 15 volt windings do not appear to be between the primary and secondary

windings which results in their purpose being minimized, ie, they would not be effective as an 'es shield'; and

- 5) the flux shorting band is poorly constructed.

Most suppliers of quality components like Ferguson Transformers, are proud to display their name and/or logos. Obviously, the manufacturer of this transformer, whoever it is, did not wish to be known.

**Doug Evans,  
Product Manager,  
Ferguson Transformers**

## VK cookbook

THE WAGGA WAGGA District Amateur Radio Club is compiling an Australia-wide VK cookbook.

Letters were sent to over 100 radio clubs throughout Australia inviting amateurs and their families to publish their favourite recipes in the cookbook.

Recipes are still coming in but we hope for more. The book will be printed and on sale at the annual convention in Wagga on October 26-27, 1985.

If you would like to be included please send your entries to PO Box 126S, South Wagga, NSW 2650 as soon as possible.

**Dave Longmore,  
VK2ZYE**

## Attitudes

IN AN EDITORIAL in the June '84 issue of ETI, comment was made on the comparatively poor educational state of Australians as a whole.

To quote some of the figures given, the proportion of those entering the workforce with tertiary qualifications increased from 3.5% in 1950 to a mere 8% today. Compare this with a rise of from less than 1% to 35% for the Japanese in the same period and a predicted 40% next year for the people of the Korean Republic! For shame, Australia!

Perhaps it is not surprising that we have such a dismal educational record. Without a strong and viable industry and a strong emphasis on research, what is the incentive for young people to devote a sizeable portion of their lives to study only to find that there aren't enough jobs available to make use of their hard won skills? Is it not much easier, and less frustrating to enter the workforce as soon as possible and get paid, or even to go on the dole?

Why does such a situation exist? It can't be that Australia is lacking in opportunity. Consider this: we export wheat, iron ore and coal. These are all high bulk, expensive to ship products with low economic returns. We import, on the other hand, low bulk, high value, manufactured goods which we could have produced ourselves.

We complain about the lack of expertise in Australia, yet, when Australia does produce individuals with outstanding engineering or scientific abilities, we do little to encourage them to stay and utilize those abilities for the national good. How often do we find that, when important discoveries or inventions are made here, they are virtually ignored by our industries and our governments? Yet, when the same discoveries or inventions are taken overseas and developed we cannot understand why Australia cannot reap the benefits which may result.

The problem, as I see it, is not that Australia is lacking in resources or opportunities. It has those. The real problem, I believe, is one of the attitude of Australians to each other and to the nation as a whole. As long as this remains as it is, then I predict that Australia will continue to slide downhill socially, economically and technologically.

Each generation inherits the consequences, good or bad, of the actions of past generations. The coming generation cannot be blamed for the problems which it has inherited as a consequence of the greed, mismanagement or apathy of its predecessors. However, it will have to deal with them as best it can and it will have to find ways to solve them if it is going to survive. I believe that, to accomplish this, a sound education above all else is essential, not just education in the arts and sciences but also in moral and ethical values. Let's hope that, for the sake of the future of all Australians, education will be given the priority that it deserves.

**H Nacinovich,  
Gulgong, NSW**

## Another perspective

I WRITE in connection with the 'Perspective' article by Mr Jim Rowe in the June '85 edition of ETI. The article criticizes in the strongest terms an obviously unsatisfactory situation surrounding the establishment of a "self help" television translator service at Elliston, SA.

I take the strongest exception to the association, by inference, of Telecom with this matter. Like Mr Rowe I learned of this situation from viewing the ABC program "Countrywide". As the Head of Broadcasting in Telecom for many years I can assure Mr Rowe that Telecom was totally without involvement and my viewing led to immediate enquiries of the Department of Communications in order that I might ascertain the true facts.

On the other hand Mr Rowe may be saying that he is not associating Telecom with the Elliston situation and is merely including Telecom in his attack on "the actions of the bureaucrats and technocrats" during his "25 odd years". I do hope Mr Rowe is only generalizing because during my "30 plus" years of occupancy of positions of influence and authority in the National Broadcasting transmission sector I have neither met with, nor received, any complaint from the gentleman.

I am proud of the efforts of my staff and colleagues of the Telecom Broadcasting Directorate who have, over the years, constructed in excess of 400 transmitting stations for the National service, many under difficult conditions and in the remotest areas. All of this has been done efficiently and with great cost effectiveness and above all without fanfare or self promotion.

**Leon Sebire,**  
Director Broadcasting,  
Telecom Australia

#### ETI-699

I HAVE JUST completed the ETI-699 300 baud modem kit (May '85). I now have it up and running on my Microbee computer. Let me congratulate your magazine on such a brilliant kit! It was easy to build (although the S3530 chip took some chasing) and I managed to get it going first time. It works like a charm.

A few points come to mind, though. It was mentioned in the magazine article that an auto-dialling board was possible for the kit if enough people wanted it. I register my vote!!! With the number of people now using bulletin boards, there is too much time wasted in dialling the number. I know that with the Microbee, and an auto-dialling modem, I can set the computer to continually dial the number until answered. This board would be fairly simple to implement, and would enhance the kit many fold.

A question about the kit I have concerns the coming 1200/75 baud standard that Telecom is introducing for its Viatel service. I was wondering if modifications to the kit can provide these extra baud rates, or is ETI planning a similar kit modem to the 699 to do the job?

**Darrin Ward,**  
Mosman, NSW

*Answers: The ETI-699 can't be modified to run at 1200 baud, but improvements to it are in the pipeline. Keeping watching! See the July issue for an experimental auto-dialler.*  
— Ed.

#### CD review

YOUR REVIEW of the Marantz CD44 and its service record (May '85) prompts me to describe an incident with my CD44.

In January this year, in Sydney, I bought a CD44 compact disk player at a very good price. I decided to return to Perth not long afterwards and bought a cheap car to make the trip.

Outside Wilcannia we had a blow out at 100 kph. The vehicle left the road and rolled.

The car was a write off and all our possessions were strewn over the road. The CD player had left its packaging and was lying in the dirt with a dented case when I found it. Its mains cord was severed and the audio lead partly cut.

While in hospital I considered leaving the disk player where it was convinced it would never play again. But during recovery I decided to see how bad it was and replaced the broken cords and cleaned it up.

To my surprise the player worked perfectly and still does. I am presently listening to Mozart on a CD.

Congratulations on a well rounded magazine.

**Peter Birrell,**  
South Perth, WA

#### Consumer rights II

I WAS SURPRISED to read of David Hynd's difficulty in obtaining a service manual for a National VCR (letters, May 1985). I purchased a National NV850 VCR in November 1984 and subsequently obtained a service manual from National Panasonic in Kewdale. I gained the distinct impression that this was a rather unusual request from anyone other than a servicing

organization, however my order was accepted (there were none in stock), and the manual arrived within a week — cost \$55.

I had less success with Philips when I tried at the same time to obtain a service manual for my Philips KL257 colour TV which was purchased new about six years ago. I was told by Philips Industries in Belmont that service manuals are available only for currently produced models — my set is out of production and the manual is no longer available. Rather annoying, but a plausible explanation.

However, the explanation was not quite so acceptable when I enquired about modification details to correct picture tearing when the set was used with a VCR. This is a common problem in earlier TV sets caused by the inability of the horizontal flywheel circuit to respond to short term variations in sync pulses from the VCR. Philips stated that such information could not be disclosed to the general public, and added that they could send a serviceman around to cure the problem at a cost of around \$45, or alternatively I could bring the set in myself in which case the charge would be around \$25. I finally got the information I wanted from another source — the modification is nothing more than adding two short jumpers across the pins of an IC, about two minutes work.

It seems that the Philips' advertising jingle "We want you to have the very best" doesn't apply to service information for its products.

**Lex Harris,**  
Morley, WA



Letters to the editor are welcomed, and should include the author's name, address and telephone number. They should be forwarded to:  
The Editor,  
ETI, 140 Joynton Ave,  
Waterloo, NSW 2017.

# Satellite manoeuvres

**As the time for the launch of the first of the Aussats approaches, Telecom has just signed the first contract with Aussat for capacity on Aussat 1.**

The agreement covers two Aussat transponders and will be used to supply the Iterra service. Two TV networks have also signed up for a transponder: both Channels 9 and 10 have signed up for a 30 watt transponder each.

Meanwhile the battle for use and control of individual facilities on the satellite is hotting up. At the same time the technical difficulties that seemed so troublesome just a few months ago seem to have abated.

The supply of equipment from Plessey appears to be on time, in spite of widespread scepticism earlier in the year about the ability of Plessey to deliver. But the government's battle to hold prices down to \$1500 appears to have been lost.

The Sydney based satellite distribution company Acesat has announced that it has ordered BMAC decoder units from Plessey. According to manager Doug Sawtell, a complete Acesat kit will cost about \$2000. Other suppliers will probably be more expensive. It may be possible to shave something off this price by going to a smaller antenna. The Department of Communications (DOC) recommends a 1.5 m dish, however in high strength areas 1.2 m appears adequate.

Acesat claims it will be ready

for delivery in October. It also appears that development work by Aussat is on time. Scheduled start of services is still November 1, 1985.

On the political front, battle royal is being waged between the big city networks and the small regional stations for control of the system. Early government schemes, in which special broadcasting entities would be set up to run a single commercial service, seem to have withered.

The final stab in the back may well have come from the government's own communications minister with a commitment to "equalization of services". Briefly, DOC minister Duffy said that the government was committed to a policy of giving people outside the main centres the same service that we take for granted in the city. That is to say, two government channels and three commercial ones.

Getting the ABC out to the people is no problem since it already has a wide band terrestrial network supplied by Telecom, and guaranteed space on various Aussats to provide complete coverage. Plans are well afoot for the rapid extension of SBS services as well, mainly via UHF and a combination of Telecom bearers and satellite links.

The commercial channels represent more of a challenge, not

in a technical sense, but on political and economic grounds. The facts of life are that the biggest commercial broadcasters are the three metropolitan broadcasters who have outlets in most of the capital cities. They are enormously profitable and the treasure trove is jealously guarded. They also have tremendous political clout at the highest political levels. The heads of these organizations have the ear of cabinet.

But the fight is not one sided. The regional channels are a lot smaller, but they enjoy an entrenched monopoly in their local areas, and represent a substantial return on investor's money. They also exert political clout far in excess of their size. Most country politicians find it prudent to stay on the right side of the media moguls in their area. Any cabinet minister making decisions against the regionals will have a back bench in revolt.

The Government must weigh this interest up against a desire by the big three to use the satellite to network. Under this scheme they would transmit the same signal all over the country via satellite. It would be retransmitted by ground stations in the major centres, and received 'fortuitously' by anyone, anywhere, who cared to put up a dish to catch the signal.

The agreement signed between Channels 9 and 10 and Aussat does already provide this to a limited extent. As things stand, when Aussat goes up both networks will use the transponders to relay signals around the country, instead of Telecom bearers as they do at present. However, the signal will be too weak to be picked up by the type of system envisaged for domestic use. There is also some likelihood that the signal will be scrambled.

The regionals, naturally, are not too happy with all this. Over the past year or so they have put up a number of proposals. The one that comes closest to meeting their needs at the moment is called 'aggregation'. A policy of aggregation means that three adjacent regional areas will be joined together, and the three present monopoly broadcasters allowed to transmit through all three areas.

Which of these two groups will prevail depends in large part on the report of the DOC's Forward Development Unit. The FDU was set up by Minister Duffy to advise on methods of achieving his equalization policy. The report is due out shortly. Things are so delicately poised at the moment that this report may well be decisive.

## Movie glamour for R&D

Minister for Industry, John Butten, has announced that as of July 1, R&D expenses will be 150% tax deductible. Motivation for the move is a desire to lift the Australian game. As things stand we spend only 0.22% of GNP on R&D, less than most European and Asian countries, and even less than New Zealand.

The cost of this is part of the \$4b that Australia now pays on high technology imports. Ac-

cording to Dr Graham Hellestrand, a senior lecturer in computer science at NSW University, much of this is spent on chips and circuit boards, that we have the talent and facilities to produce here.

Dr Hellestrand was also highly critical of the Department of Defence and Telecom Australia for its purchasing policy. Most countries of the world have national purchasing policy in the area of telecommunica-

tions and defence. "There seems to be a concerted effort to stop that from happening here," he said.

Tax concessions, import offset and bounties are "superb", according to Hellestrand, but such policies will not result in a viable technological base without major contracts. In the first instance they must come from the biggest purchasers of high technology goods: Telecom and Defence.

The idea of using the tax system to encourage industry has been tried before in Australia, notably in the movie industry. However it has been heavily criticized as inviting abuse of the system. It remains to be seen whether the new scheme will invite a repetition. The minister has said that he will wait until the scheme is introduced into parliament before outlining procedures to prevent abuse.



## More from Wild

CSIRO chairman Dr Paul Wild has urged his scientists to speak out about the social, moral and political dilemmas that face society today.

CSIRO is the biggest research organization in the country. Dr Wild said it was crucial to Australia's future that the public become more aware of the importance of scientific research. "It is central to many of the concerns we face in Australia, like

public health and safety, the competitiveness of our industries, the quality of our environment and the management of our soil and water," he said.

The CSIRO has recently revised the guidelines for staff wishing to make comments at public meetings or in the media. Under new guidelines, staff do not need to get executive approval before speaking out on issues of concern.

## BRIEFS

### Maths future

Interested in maths? Students considering doing a maths major should get hold of a booklet from the Australian Mathematical Society designed to make students aware of the employment potential for maths graduates. Contact the president of the society, Bob Anderssen, c/- CSIRO, DMS, GPO Box 1965, Canberra, ACT 2601 or phone (062)82-2011.

### Telecom security

Telecom is setting up a new security network called Securitel. It uses phone lines to connect premises to security companies which then monitor the premises around the clock. Detectors not only sense intruders but sense any attempt to tamper with terminal equipment. TNT's security terminal at Flemington in Sydney is among the first connected to the new network.

### Electronics for women

Royal Melbourne Institute of Technology has started a special electronics course for women. The two year course leads to an electronic technician's certificate. Applicants should have completed year 11 maths, English and physics. More details from Arthur Geondeve on (03)663-5611, ext 425.

### Certified customers!

Intel Australia has recently embarked on a program to offer local training classes for many of Intel's products. The intent of the programme is to provide a quality classroom complete with hardware and software for training of prospective customers.

## Eye in hand worth two in bush

International Resource Development Inc (IRD) reports that the market for robots is beginning to take off, especially now that vision is becoming practical.

According to IRD, one quarter of all the robots delivered during the next decade will have some form of vision system. There are two main types: those that have a camera next to the manipulator (eye in hand) and those with the camera in the body of the robot. The former is preferred since it gives a much closer and more detailed view of the work face than is possible with the camera in the body.

However, fixing the 'eye in hand' concept does have some problems. It imposes constraints of size on the system, and in many applications requires that the vision system be unaffected by vibration.

Vision is vitally important in many applications of robotics. Having vision can make all the difference to the economics or practicality of an installation. A case in point is the 'blind' robot which requires special convey-

ors, or a special sorting process on the assembly line, because it can't distinguish between different components.

However, the performance of a seeing robot is determined to a very large extent by the sophistication of the signal processing. Often, cheaper systems require extensive lighting. They can perform no more than a check that a component is present. More sophisticated systems are capable of picking the desired item out of a pile in a bin, orientating it in the correct manner and then performing whatever manipulation is required, all in ambient lighting.

According to the IRD, at least three companies are looking seriously at their investment in robotics: GE, GM and IBM. For the most part they seem content to buy small corporations already invested in robotics. However, they seem set to start dominating the field in the near future owing to improvements in signal processing as a result of the US government military programmes.

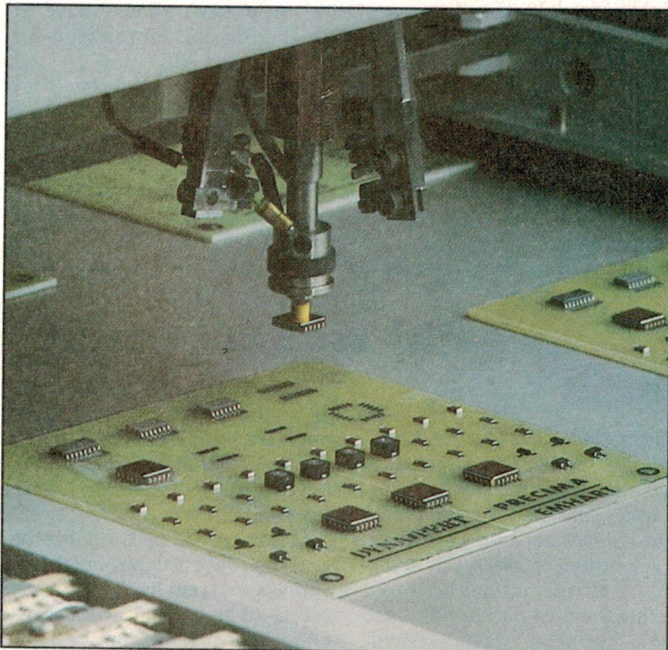
## First auto SMD

Appliance Control Systems of Sydney has placed a \$500,000 order with Penn Central for the first fully automated surface mount device (SMD) production line in Australia.

The heart of the system is a Dynapert pick and place machine. This is a robot machine which picks the SMD out of a tray and places it accurately on the substrate. In SMD technology there are no pins or other locating tabs that allow individual components to be located

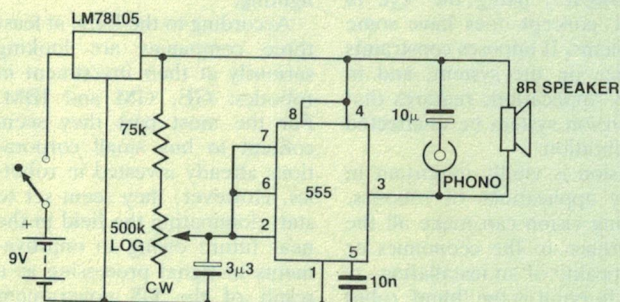
easily. At the same time, because tolerances are so small, the device must be located very precisely. For this reason automatic systems are a favoured method of stuffing surface mount boards.

It is expected that Appliance Control will now have the capacity to market about 1-2 million boards a year. Its bread and butter is processor based controllers for electronic consumer durables.



## NOTES & ERRATA

**Ideas for experimenters, Simple electronic metronome, May '85:** There are two minor errors in the printed circuit. The  $3.3\mu$  capacitor should be connected between the wiper of the 500k log pot and the negative rail, not between the pot and the rail. An improvement suggested by the author is to connect a 10n cap from pin 5 of the '555 to the negative supply improving noise immunity to high frequency pick-up. The revised circuit is reprinted herewith.



Telecom plans for a national optical fibre link took a lurch forward recently with the announcement of a \$2m contract to Komatsu for six D355A bulldozers. They are to be used to dig a trench around Australia for the cable.

**The Australian subsidiary of Westinghouse Break Co of the US has just formed a local computer applications group called Westinghouse Systems. The address is 80-86 Douglas Parade, Williamstown, Vic 3016.**

VSI has been appointed sole distributor for Hewlett-Packard. VSI claims to be the major distributor of semi-conductor products in Australia, with over 50% of market share.

**Melbourne distributor Electronic and Semiconductor has been appointed agent for K B Denver Inc of the US. Denver makes custom keyboards and switches.**

Feeling French? Go and see Promark Electronics, who are now the distributors for Thomson CSF. Promark's address is 6

Clark St, Crows Nest, NSW 2065.

**Philips has just won another contract to supply radio equipment to Telecom. The contract, worth \$1.3m, covers FM900 radios for Telecom's own fleet of trucks and cars.**

Jaycar has moved again. As at July 1, 1985 its head office and showroom is at 115-117 Parramatta Rd, Concord, NSW, (02)747-2022 or 747-1888. Jaycar is also at 188 Pacific Highway, Gore Hill, NSW, (02)439-4799, and 144 Logan Rd, Buranda, Qld, (07) 393-0777.

**Dr G E Thomas, director of the Edinburgh regional computing centre, has been appointed chief of CSIRO's new division of information technology. Most of the staff for the new division will come from CSIRONET, the CSIRO's computer network. Dr Thomas hopes to develop a programme of work that will correlate with the needs of the Australian information technology industry.**

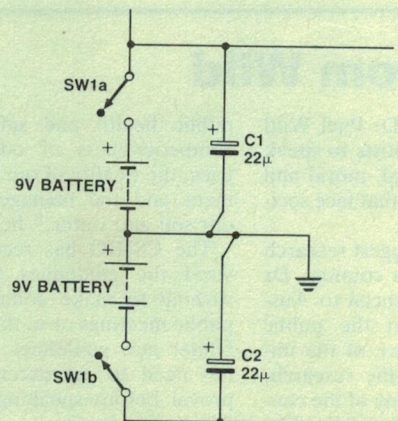
## Logica backs a winner

Logica Ltd, of North Sydney, has completed the first phase of a point of sale (POS) network for Olivetti. Olivetti plans to market the system worldwide using its Mercator hardware. Logica was awarded the contract because, amongst other things,

Olivetti sees Australia as a promising early market.

Logica expects the contract to last until mid-1986. Currently 17 people are employed on it. It involves advanced communication capabilities as well as some sophisticated programming.

**Project 183, Op-amp Tester, April '85:** The battery polarity was shown reversed in the original circuit diagram. The correct polarity is shown herewith.





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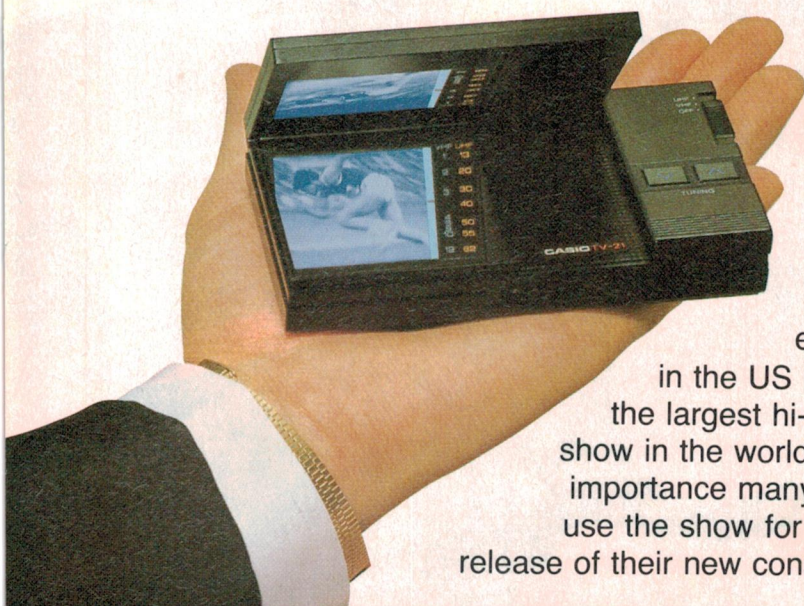
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# SUMMER CES SHOW

## a consumer electronics preview



**Jon Fairall**

The summer consumer electronics show in the US is reputed to be the largest hi-fi and computer show in the world. Because of its importance many manufacturers use the show for the world's first release of their new consumer products.

THIRTEEN HUNDRED exhibitors, over 100,000 visitors. Between June 1 and 6 they made the annual pilgrimage to the McCormick centre in Chicago for the summer Consumer Electronics Show. All the movers and shakers of US electronics were there. The makers, buyers and sellers were looking and talking. It is, so they say, the biggest and the best.

In fact it's so big it's hard to see the wood for the trees. There are so many products, so much to see and do, hucksters everywhere. One measure of the scale of things: press kits for all the products on display form a stack over a foot high.

People who came hoping to see a whole host of new technologies were disappointed. By and large there were few surprises. But no one was complaining. Electronics USA is healthy. Order books are bulging, business has never been better. Although it must be admitted, some parts of the industry are doing better than others.

### Satboom

Big talking point at the show was satellite broadcasting. Satellite related exhibits covered 10 times as much space as last year. It





reflects marketing success. There are now a million satellite systems installed in the US, increasing at about 60,000 a month.

Its dangerous to extrapolate from developments in the US satellite scene to Australia. The legal and technical differences ensure that satellite broadcasting here will be quite different. Nevertheless, there are some things we can learn from US developments. The most important is that the public *love* the idea. Secondly, the news is that prices are sliding downwards rapidly. At the moment ball park figures are US\$1300-US\$3000 for a complete system. If we have to pay more we're being ripped off.

## Video confusion

Pundits who were looking to the CES to point to future developments in video technology were disappointed. At the show's end people were still asking: "Is 8 mm here to stay?" and "Is Beta dead?"

One sign: just before the show, Toshiba announced it was beginning manufacture of a VHS VCR, leaving Sony as the only major manufacturer with an all Beta line up. However Sony chiefs are still talking up the market. Their story is that they can sell it all they make. Apparently, Sony is laughing all the way to the bank. In fact Sony announced a new Beta product at the show.

Called SuperBeta, Sony claims a 20% increase in screen definition by pushing bandwidth out to 5.5 MHz. A PAL version will be available here towards the year's end.

Beta still has technical superiority going for it. Just about everyone I spoke to preferred the Beta system on those grounds. But software availability continues to haunt it and dealers claim a smaller mark up on Beta, so they are more reluctant to carry it.

Software availability also haunted the new entrant in the field, 8 mm. The medium established itself even more firmly with the launch of Sony's new product, the CCD-8MU camcorder, which comes with a

## MINI TV RECEIVERS

Three mini TV systems were on display at the show. The most spectacular was the Casio TV 1000. It uses a colour LCD display to present a tiny NTSC standard colour image. There are no firm plans yet for release in Australia, although a PAL version, is on the drawing board in Japan and will be released before year's end.

Because the LCD screen does not emit light, but works by absorbing it, it is necessary to provide an external source of illumination. Casio has developed two modes. For use outdoors, there is a special solar projection screen. This is a mirror that flips down on the back of the unit and projects the sun's rays up into the back of the set. It provides a very bright image in daylight.

For indoor use there is internal illumination. This backlight is just a white light behind the screen that shines through it. Viewing in this mode doubles battery consumption however. According to Casio, you can get four hours continuous viewing in sunlight, two with the backlight switched on.

According to Les Brown of Mobex, the local importers, the TV 1000 will sell for around \$400, although he stressed that since the product will not be available for another year or so that was very much an approximate figure. A much firmer number is the price of the TV 21, the monochrome equivalent of the TV 1000. It will be on sale in August priced at \$230.

The TV 21 also features the solar projection screen or backlight option. It has UHF/VHF continuous tuning, with simple up and down controls to allow you to change frequency. Audio is delivered via an earphone. The earphone cord also functions as the antenna.

Another producer with a micro telly was Magnavox, the US arm of Philips International. Its product features a folded picture tube a la Sinclair, so it doesn't have any of the illumination problems that beset the Casio product. It's marketed in the US in a number of different forms: as the Escort 2 it's a tiny set with a telescope aerial, UHF/VHF tuning and internal or external speaker. A version is available with stereo headphone output.

It is also packaged as an AM/FM clock radio/TV buzzer alarm intended for bedside use. Philips is also manufacturing a slightly bigger version called the Escort 4 with the same design features as the Escort 2, but on a slightly bigger scale.

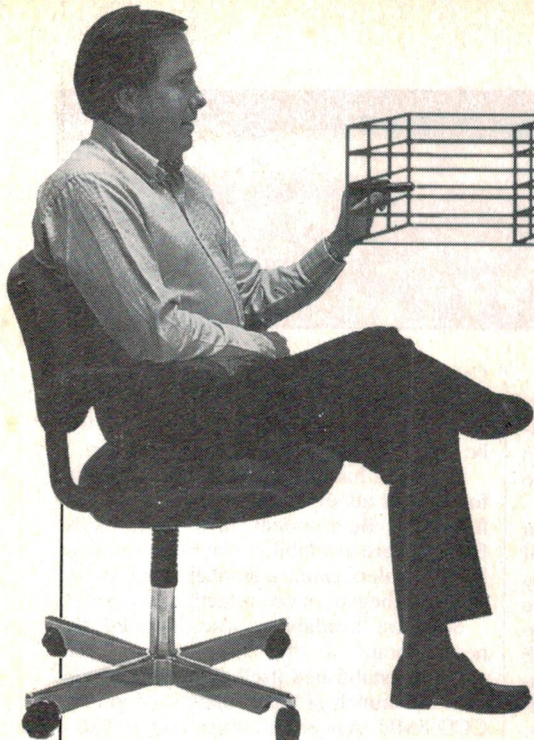


## BUSINESS COMMODORE

Probably the most interesting bit of news to come out of the computer section of the CES was the release of the Commodore 900 business computer. It uses Coherent as its operating system, which allows up to eight terminals to be served by the one computer. According to Commodore, all the software developed in the multi-user Unix market will be easily transportable to the 900.

The 900 will be available in two configurations. One will be the multi-user configuration discussed above. The other is a personal workstation. In this mode it will drive a 1024 x 800 bit mapped display coupled with a window manager and mouse for input control.





### 3D TV THAT WORKS!

People have been talking about the possibility of stereographic TV (3D TV) for quite a while. Stereographics Corp of San Raphael, California, claims that its system is one of the first practical demonstrations of the art.

The basic idea is that the screen displays two discrete images for the two eyes, and these are related to each other in such a way that a 3D illusion results. Two screens are obtained in this system by time multiplexing the screen at 120 Hz. At the same time the viewers' eyes are covered and uncovered in phase so that the left eye receives only the left image, the right eye only the right image.

This obscuring of the eyes is done with a special screen. The screen is worn in front of the eyes and looks rather like a set of safety glasses. It is actually composed of liquid crystals. These are set to be transparent and opaque at a 120 Hz rate in phase with the screen. Communication between the visor and the TV is made via a cable.

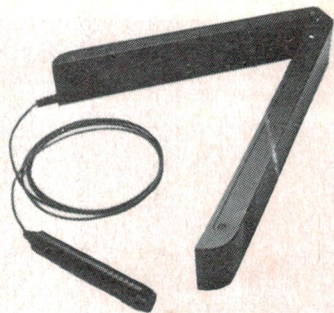
Does it work? Yes it does, and surprisingly well too. Unlike earlier systems, which required very careful positioning of the screen and the observer, the system is totally flexible. You can view it from anywhere, hold and tilt your head to any angle without losing the illusion. In addition, if you stop looking at the screen to look around the room, as happens in real life situations, your view is totally unimpaired. The 120 Hz oscillation of the crystals is very much faster than the flicker rate.

In fact it is four times the frame rate (twice the field rate) of US TV, which leaves one to suppose that it would not be very difficult to generate real time 3D images with this system. In fact that is just what Stereographics Corp claims. It produces a twin camera rig that consists of two conventional cameras mounted side by side. Unfortunately, the company wasn't able to demonstrate this at the show.

One thing Stereographics did demonstrate was a Spacepen, manufactured by Soniture Corporation for drawing in 3D. This uses a sonar arrangement on the pen to specify its position in a three axis system.

To achieve the illusion of depth it is necessary to distort the Z axis by a factor of 6, so that one is left with an operational cube in front of the screen one foot by one foot by six feet (30 cm x 30 cm x 1.8 m). Within this cube the position of the pen can be defined to within 0.1".

Soniture apparently has developed software to allow drawing on a conventional two dimensional screen as well as in 3D. If you have an application in mind, contact **Stereographics Corporation, PO Box 2309, San Raphael, California, USA.**



### 8 mm — THE NEXT VIDEO FORMAT

For video freaks, 8 mm technology was undoubtedly the talking point at the CES. 8 mm emerged as a full blown competitor to the half inch tape formats like Beta and VHS.

Three manufacturers displayed their wares: Kodak, Canon and Polaroid.

Kodak is marketing its system as the Kodavision Series 2000 video system. It includes a camcorder called the Model 2400. This is a combined camera and recorder that comes with a built-in microphone and a black and white monitor in the eyepiece. You can play back in this monitor for instant replay on location.

The 2400 is designed to slip directly into the Model 3030 Cradle. The Cradle is designed primarily to control the replay of cassettes in the camera, but it can be beefed up to act like a full VCR. There is an optional tuner/timer module that gives you all the facilities that you would expect on a standard VCR. It even includes infrared remote control.

Kodak has gone to a considerable amount of trouble to design the audio parts of the Series 2000. It uses a PCM sound system which gives CD comparable results according to Kodak. There are six tracks, which can be

utilized for stereo reproduction when replaying commercial software, or alternatively can be used to provide multi-tracking facilities in home productions.

Although the push for 8 mm video has come from those who see it as a replacement for 8 mm film, Kodak is acutely aware that success or failure of the medium depends on it obtaining some market share from the conventional half inch technologies. One question I put to Kodak officials at the show was whether Kodak was considering supply of software, since lack of software is seen as the major weakness of the format.

The answer: a carefully hedged yes. It appears that Kodak is hoping that traditional software suppliers will move into the market and start making products available. If they don't Kodak seemed to be prepared to step in and give things a push. According to one spokesman: "it's the old chicken and egg syndrome. No one will supply until there is a market for software. But we can't sell hardware until the software is available".

Canon was the only Japanese maker directly selling its 8 mm wares at the show. Its rig consists of a VC 200A colour video camera, a portable video recorder, the VR-E10 and the VT-E10 tuner/timer unit. The camera uses a Saticon picture tube rated at 3.9 MHz and title generation facilities. The VCR uses a four head drum just 40 mm across. The speed of the tape transport mechanism is monitored at over 1000 Hz to ensure it is within tolerance. Tape speed is nominally 14.345 mm a second, which gives 90 minutes of playback from a normal tape.

According to Ian Threasher of Canon, the company will be entering the fray towards the end of the year in Australia. Exactly what product will be released, and what it will cost, is still unknown. Watch this space!

The Polaroid system is another system like Kodak's with a camera that docks in a playback unit to provide VCR capability. It is manufactured in Japan but sold worldwide by Polaroid. Polaroid has no plans to release it in this country at the moment, so if you want one phone a friend in the US...



matching EV C8U playback recorder. It features a PCM sound system that gives quasi CD quality, and in fact has an audio only mode that gives two hours worth of programming.

As things stand now, major players with 8 mm video product report sales slow but steady. There are considerable size and price advantages in the 8 mm format. The only thing holding back acceptance is lack of prerecorded software, and also, perhaps, buyer confusion.

## Computers out in the cold

The computer industry is suffering badly from the effects of a downturn in demand, and this is reflected in lacklustre displays by many of the computer manufacturers. Neither Coleco or Atari showed any hardware at all. Industry leaders are saying that bad publicity is obscuring the fact that there is still growth in the market. Industry researchers project 10% growth for 1985-86. Nevertheless there is a feeling in the air that the shakeout hasn't finished yet, and industry executives are considering the future nervously.

Commodore is hedging its bets with a move into the business market. Two new

systems were on show here, both scheduled for release in Australia before year's end. The PC10/PC20 is an IBM clone with 640K RAM onboard. The Commodore 900 is a Unix based business machine with a high definition (1024 x 800) screen, provision for networking up to eight terminals and a hard disk add on that will store 67 Mbytes.

The new wisdom in the computer world is that the industry will be far more software driven than in the past. The idea is that users will approach a computer purchase with an application in mind, and select software to suit the application. They will view hardware only as a means of running the software.

This stands traditional assumptions about the home computer industry on their heads, but it was reflected in lively software displays by all the large US software houses. Games were there in profusion, with packaging even more garish than ever. No doubt a development spurred on by a special competition to find the most exciting packaging and display concepts for software.

To my mind the most interesting displays were at the Sublogic stand, where latest releases in the flight simulator series were on show. Latest development: the 'Jet'. It's a

simulation of an F16 jet fighter with a choice of carrier or land based operation. (And yes Mother, I did try, and I got wet.)

## The little boom

The most remarkable thing that happened to audio during '84 was undoubtedly the CD revolution, which has revitalized the audio market as consumers rush to update. Prices have been on a negative ramp all year, so much so that people are predicting under US\$100 prices by year's end. Record manufacturers are replying to consumer demand by rapid increases in new releases. Predictions are that CD will outstrip combined tape and LP releases in 1986.

Undoubtedly the CD star this year: Sony's D50 mini portable player. The big question: when would it run into competition? Well, the answer is: right now. Technics is the challenger, with the SL XP7. In fact, the remarkable thing was the number of low end audio applications for the CD player that appeared at the show. Toshiba is marketing a semi-portable version complete with CD, tape and tuner, and most of the major manufacturers had models for motor car use.

## TV — big and small

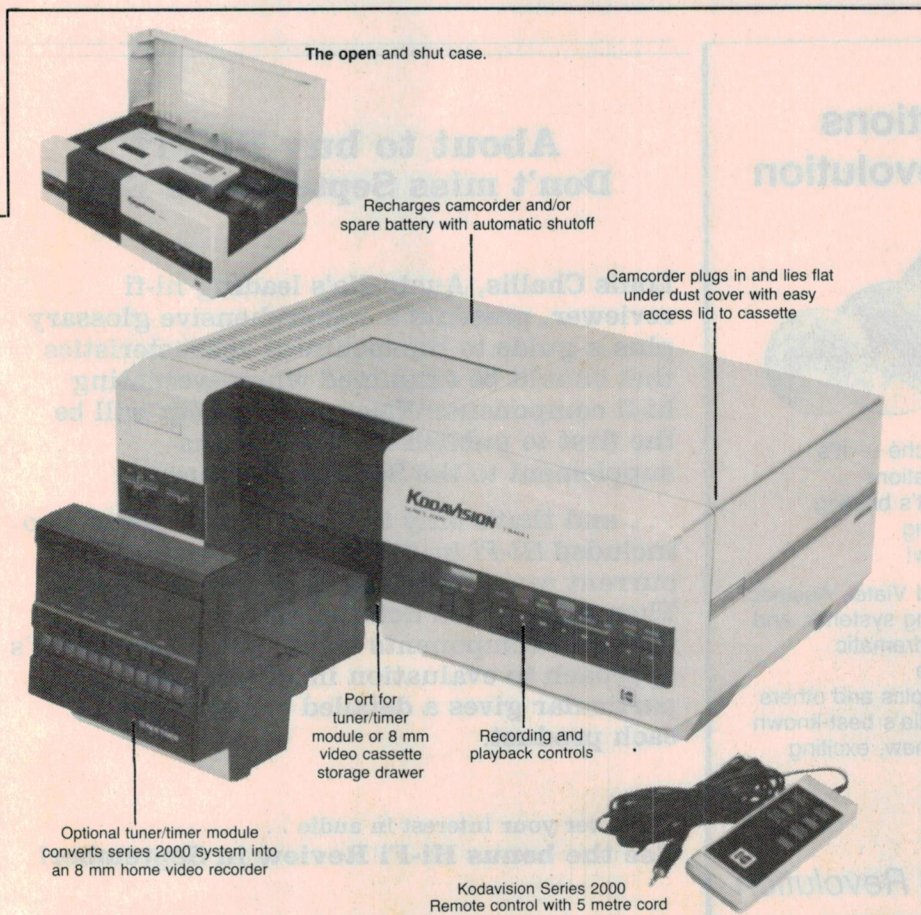
Colour TV penetration has now reached saturation in the US, with figures much like Australia of about 98% of all households. According to figures circulating at the show, typical households replace their sets every five years, with half of all sets lasting fifteen years. In an effort to ginger up demand, a number of new developments appeared.

TV screens are getting both bigger and smaller. One of the sleepers at the show was projection TV, which is finally leaving behind its sleazy blue bar room image and becoming an acceptable display medium. Two types are emerging, the traditional three gun projector and screen type arrangement, and the rear view screen, which just looks like a super big TV set. Typical sizes: 37 inch diagonal. The rear view screen is intended for domestic use, especially allied to big sound stereo TV.

At the other extreme, Casio and Magnavox showed off tiny portable items. Casio has settled on LCD technology to make colour and monochrome versions with 2.6 inch screens. Magnavox, using Sony patents, has developed a folded tube version. All these products come with VHF/UHF tuners and headphones. (See box.) The quality of the picture is not very good, but novelty and flexibility will make them hot sellers.

## Magic phones

Telephones are becoming a glamour item in the US as the market opens up under deregulation. There is strong interest in cordless phones, accounting for some 17%



of all phone sales in 1985. Regular corded phones also attracted strong interest, with an endless proliferation of styles and features. Auto redial, memory and single digit dialling are also common features. Actually, it's becoming quite difficult to find a telephone without any add-ons. (They are called POPs by the cognoscente: plain old phones.) And dials are right out.

Cellular telephones are starting to make an impact, with many different manufacturers displaying wares. Demand for cellular phones appears to be strongly regional in the US. Some cities, like Chicago, report strong demand. In others makers are finding they can't give the things away. Dealers offer no reasons for consumer behaviour.

## Magic products

Predictably, there were also a host of products produced by little companies all over the US that don't fit into any easily defined category. Most will probably sink without trace, but they do give some idea of the variety on display at the show.

Sublogic, for instance, has produced a high speed graphics card with its own board processor and analogue RGB outputs. The analogue output gets rid of the harsh defini-

tion and aliasing of most computer derived imaging and gives a much more pleasing display.

Stereographics Corp had a real live 3D TV system on display. (See box.) There was also a home sensurround system which uses the six tracks on an ordinary movie soundtrack to create sensurround effects. It's marketed by Surround Sound Inc as the SSI-720.

My favourite bit of information from the show? Pioneer has reduced the cost of the low end laser video disc to \$299 in the US. Laser disc is a technology that refuses to lie down and die, in spite of endless funeral orations. It is the closest thing to video perfection we have this side of high definition TV. In fact it makes VCR technology look a little tawdry. Pioneer unveiled a new player that allows one to play both video discs and CDs. It's another attempt to make the product more attractive. I hope it succeeds.

Speaking of high definition TV (HDTV), Toshiba unveiled its new HDTV system competing with the Sony system released at mid-year. It has a 30 MHz bandwidth, with time multiplexed video components, but Toshiba has squeezed bandwidth to 8.2 MHz for broadcast use.

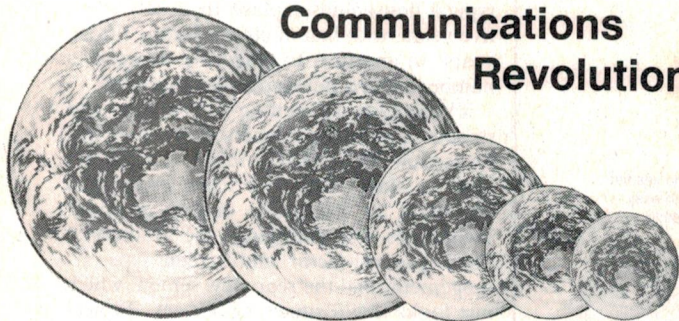
## The Chevy by the levee

By the time you read this, the 100,000 participants will have upped pegs and disappeared into the sunset like so many John Waynes in a bad western. From all the hype and razzmatazz, an image in Chicago 85: out on the levee in front of the convention centre where Chicago juts into Lake Michigan was the exhibit of Bubb Corp, makers of car speakers. Just to show what could be done, Bubb customized a Chevy van. It has calf skin seats and shag pile carpet on the floor. Into this they put two five and a quarter inch speakers on the front doors. A further two mount on the rear hatch. Two six by nines sit on the wall amid-ships and a further two on the seat back. Each speaker is fed by its own 25 W power amp. The whole rig is sourced by a CD player. I got in and turned the volume up. Silly move.

Next to the Chev they had parked an AMX Javelin, a super long, super low, blue (yes Mother, blue) phallic salute to the American dream. Inside 36 five-and-a-quarter inch speakers where the rear seat should be.

"Just for the hell of it," said the man from Bubb, "Just for the hell of it."

## Australia's Communications Revolution



The Shrinking World is no longer just a cliché — It's today's reality. And the current Communications Revolution is not just shrinking the world, it's binding it together ever more tightly with the exciting developments that are happening right now!

Satellites, cable TV, Teletext, Videotex and Viatel, Austpac, fax systems, Teletex and Telememo, paging systems, and digital PABXs are playing their part in the dramatic changes that are revolutionising world-wide communications. These rapidly evolving topics and others are covered by Stewart Fist, one of Australia's best-known and respected technical writers, in this all new, exciting publication from Federal Publishing.

**Watch for it in October!**

*Australia's Communications Revolution*

## About to buy Hi-Fi? Don't miss September's ETI

Louis Challis, Australia's leading hi-fi reviewer, presents a comprehensive glossary plus a guide to the technical characteristics that should be examined when evaluating hi-fi components: *Electronics Today* will be the first to publish it in our bonus supplement to the September issue.

... and that's only the beginning. We've also included *Hi-Fi in 1985* which surveys the current renaissance in high fidelity audio. Then we've added detailed reviews of a dozen different components which show the expert's approach to evaluation in general and in particular gives a detailed examination of each product.

Whatever your interest in audio...

**See the bonus Hi-Fi Review in September!**

# Who says business and pleasure don't mix?

With the introduction of the CPC664, Amstrad has stolen a further march on its competitors in the home and personal computer market.

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## Introducing the Amstrad CPC 664 with floppy disc drive



and there is provision for a second disc drive and data cassette recorder to be connected to the system.

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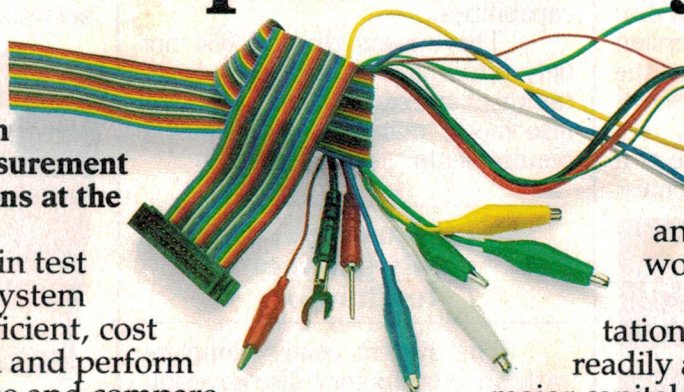
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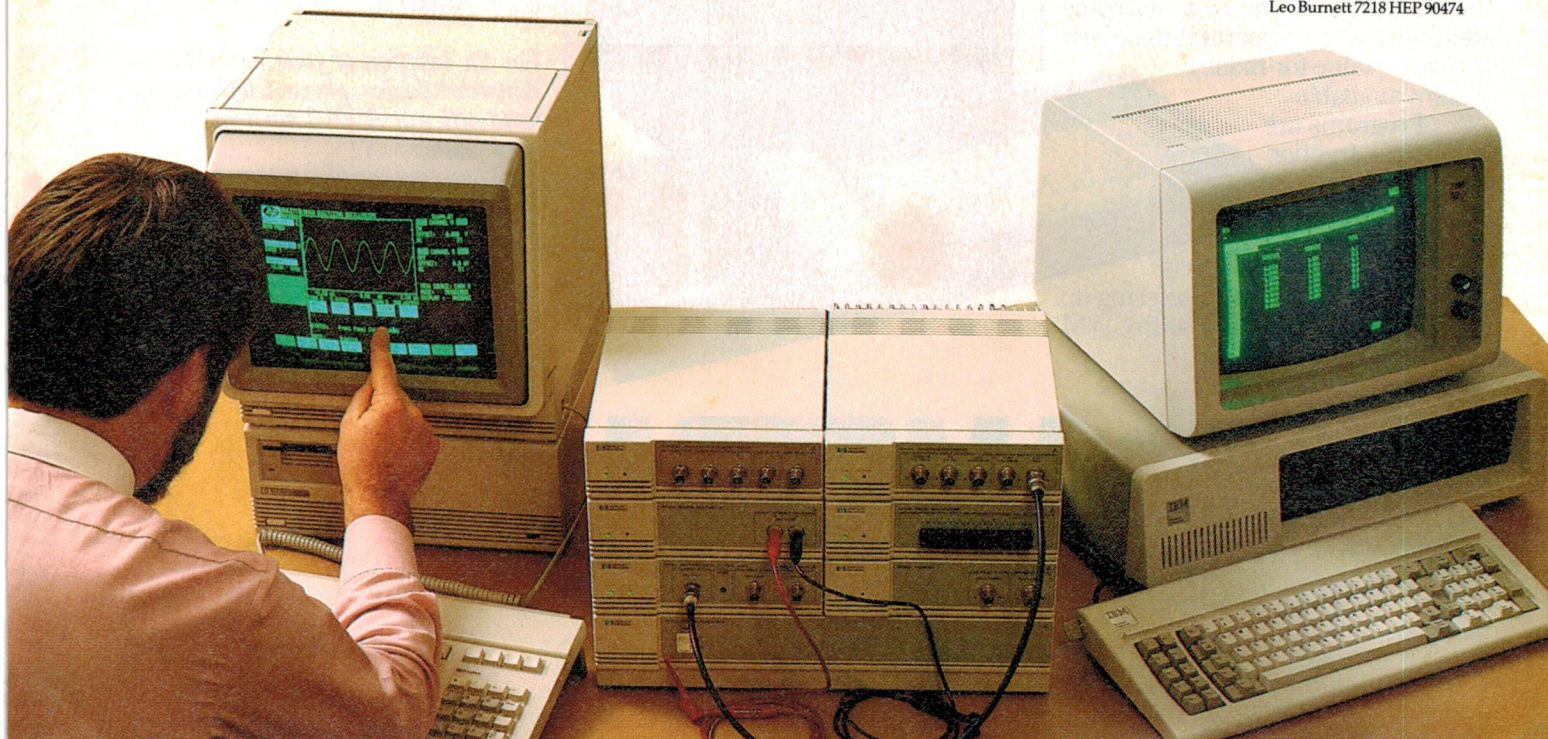
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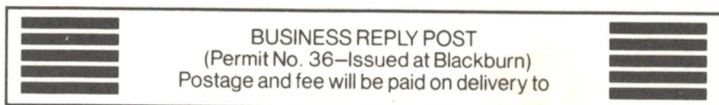
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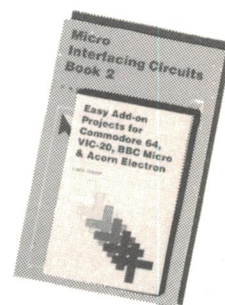
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# KEEPING THE WHEELS TURNING

## JVC KD-V400A stereo cassette deck —

The value of the ordinary cassette can be overlooked in the rush of developments, but it's still a convenient medium for your choice of uninterrupted sound. The modern cassette player offers good recording features, great replay and a few other up to date controls!

**Louis Challis**

UNTIL RECENTLY I had the impression that the most sophisticated of the cassette players on the market were the most expensive, and that the less expensive cassette players didn't provide the sort of controls, the type of displays or the most obvious features that the intending purchaser would desire.

One cassette recorder which has completely changed my attitude is the JVC KD-V400 stereo cassette deck which provides all the features that you or I could reasonably ask for in a neat, attractive and extremely functional package. They include the ability to be able to record and replay in both the forward and reverse directions without rotating the tape and the ability to automatically cycle that process on a single cycle or multiple cycle basis.

### **Design features**

The unit we received for review was visually slim with what I would describe as a relatively technical front panel, with the controls and displays laid out in four separate horizontal groupings. The front panel surrounds are fabricated in brush satin aluminium with inserts which are mainly dark and sombre until the 'lights start flashing'.

At the left hand side of the panel is the ON/OFF switch below which is the TIMER switch to facilitate delayed recording or playing when the mains power is subsequently activated by the optional electronic timer. Immediately below this is a tip ring and sleeve HEADPHONE socket (for which no volume controls are provided) and

a pair of MICROPHONE sockets for unbalanced microphones with impedances between 600 and 10k ohms.

To the right of this is a large and unusual multi-coloured multi-functional display unit which shows the absolute peak signals for left and right channels over the range -20 to +9 dB. The range -20 to 0 VU is blue whilst the range above this to +9 is coloured red. It also provides plasma type peak level displays for the spectral peaks for signals in both of the channels. In this display is a somewhat simplified real time analyzer in which the bandwidths of the filters are two octaves wide with centre frequencies of 63 Hz, 250 Hz, 1000 Hz, 4000 Hz and 12,500 Hz respectively. This neatly covers the range 32 Hz to 20 kHz with characteristics which can only be described as a 'poor man's' real time analyzer. They are nonetheless informative although not necessarily very important unless you are recording at peak levels and are worried about the likelihood of saturation.

To the right of the peak signal displays is a four digital counter, below which is a display informing you whether Dolby B or Dolby C has been selected and which of the possible tape REVERSE MODES is operational. Below the display are switches for selecting NORMAL, METAL or CRO<sub>2</sub>, noise reduction ON or OFF, DOLBY B or DOLBY C. To the right of this are two buttons designated memory PLAY and STOP which allow the tape to automatically stop at a predesignated counter position when winding in the FAST FORWARD or RE-

VERSE mode or to start playing when winding in the music scan mode.

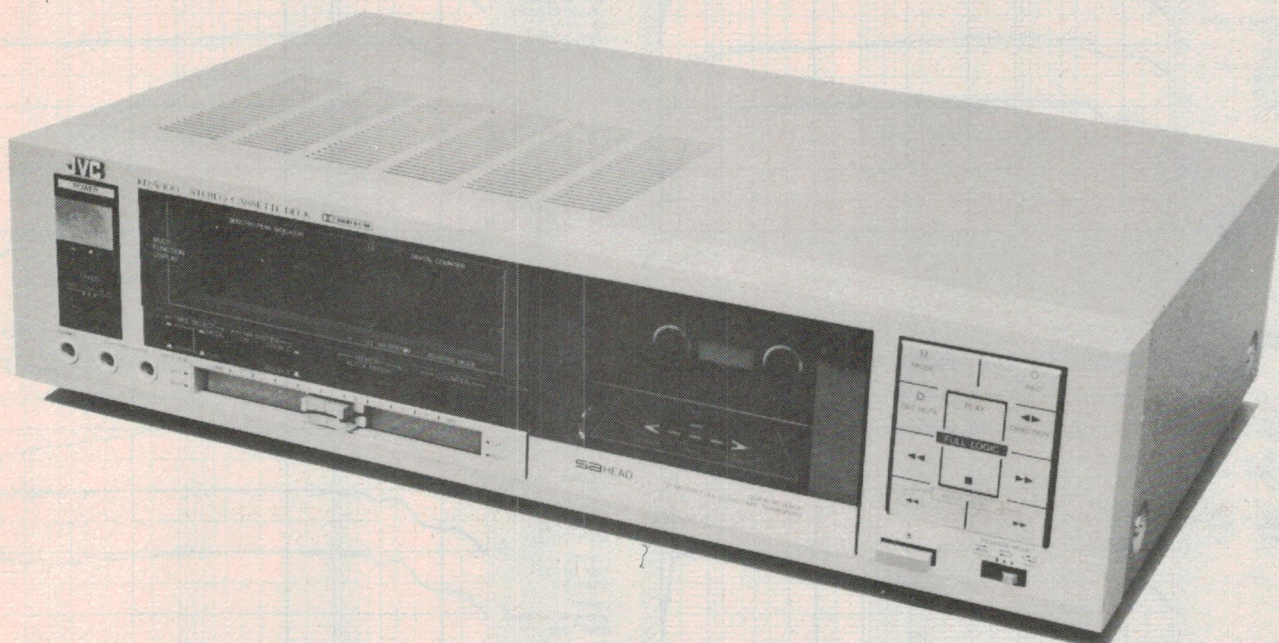
Adjacent to this are two switches which allow you to set the number of musical segments which you wish to skip over, simply by punching in the number of gaps between pre-recorded numbers, which have to be skipped over prior to setting the recorder in the fast forward or reverse mode. Adjacent to this is a RESET button, which allows you to correct those inadvertent mistakes. Immediately below these controls are a pair of horizontal slide switches, which conveniently allow you to adjust the recording signal level with much greater ease than you obtain from a similar rotary control.

On the right hand side of the front panel is an unusually neat flip-down cassette well, controlled by a pneumatically damped mechanism. The well contains an integral LED display which indicates the direction of travel selected with green arrows, whether the tape is moving, by means of three other green bars, and whether recording mode has been selected, by a separate red bar. In the pause mode the middle green bar lights up to tell you what's happening.

On the extreme right hand side of the control panel is a particularly neat keypad control system using ten neatly labelled segments.

In the very centre of the fully electronic logic keypad are the PLAY and STOP controls. Around the four sides of these are the PAUSE, RECORD, RECORD MUTE, forward or reverse play DIRECTION re-

**Dimensions:** 435 mm (wide) x 110 mm  
 (high) x 280 mm (deep)  
**Weight:** 4.8 kg  
**Manufacturer:** Victor Company of Japan  
 Limited, Tokyo Japan  
**RRP:** \$449



versal switch, the FAST FORWARD, FAST REWIND and at the bottom, the MUSIC SCAN fast forward, fast rewind controls.

The music scan control works in conjunction with the scan set button, described above, to rapidly find the designated musical number on a tape.

Immediately below the electronic logic keypad is the large EJECT button and a switch which sets the tape play reversal mode to unidirectional, single reversal or continuous reversal.

The rear panel of the module has two pairs of RCA type coaxial sockets for left and right channel line-in and line-out and a voltage selector switch with a 2 metre double insulated unearthed mains leads, terminating in a two pin plug for Australian conditions.

The cabinet is fabricated almost entirely from steel and features a well ventilated slotted top cover in full compliance with Australia's latest electrical safety requirements.

It's the inside of the unit which shows up how much the unit contains and how well it is executed. The main 'mother' printed circuit board contains a particularly well designed and labelled board on which one minor board is located with the Dolby circuitry, and interconnects by ribbon cable to separate sub-boards immediately behind the front panel. A separate and relatively large printed circuit board is located immediately behind the front display module and this contains a number of large scale

ICs, one of which has 82 pins located on the four sides and which provides the normal peak and spectral peak reading characteristics.

It is the cassette drive however which is probably the neatest component within the deck. This is interconnected to the main board by means of a number of plug-in leads (which are not ribbon cable) and incorporates three motors with two large diameter drums for the capstan drive to provide the forward and reverse capabilities.

The method of manufacture chosen for this drive achieves particularly good performance from relatively inexpensive components (which are integrated separate components made from moulded plastic, phenolic and pressed galvanized steel). The two large capstan drums in particular have obviously been designed to enhance the wow and flutter performance. Last but not least, the mains transformer is carefully located in an angled position on one side of the chassis so as to minimize stray flux leakage.

### Objective testing

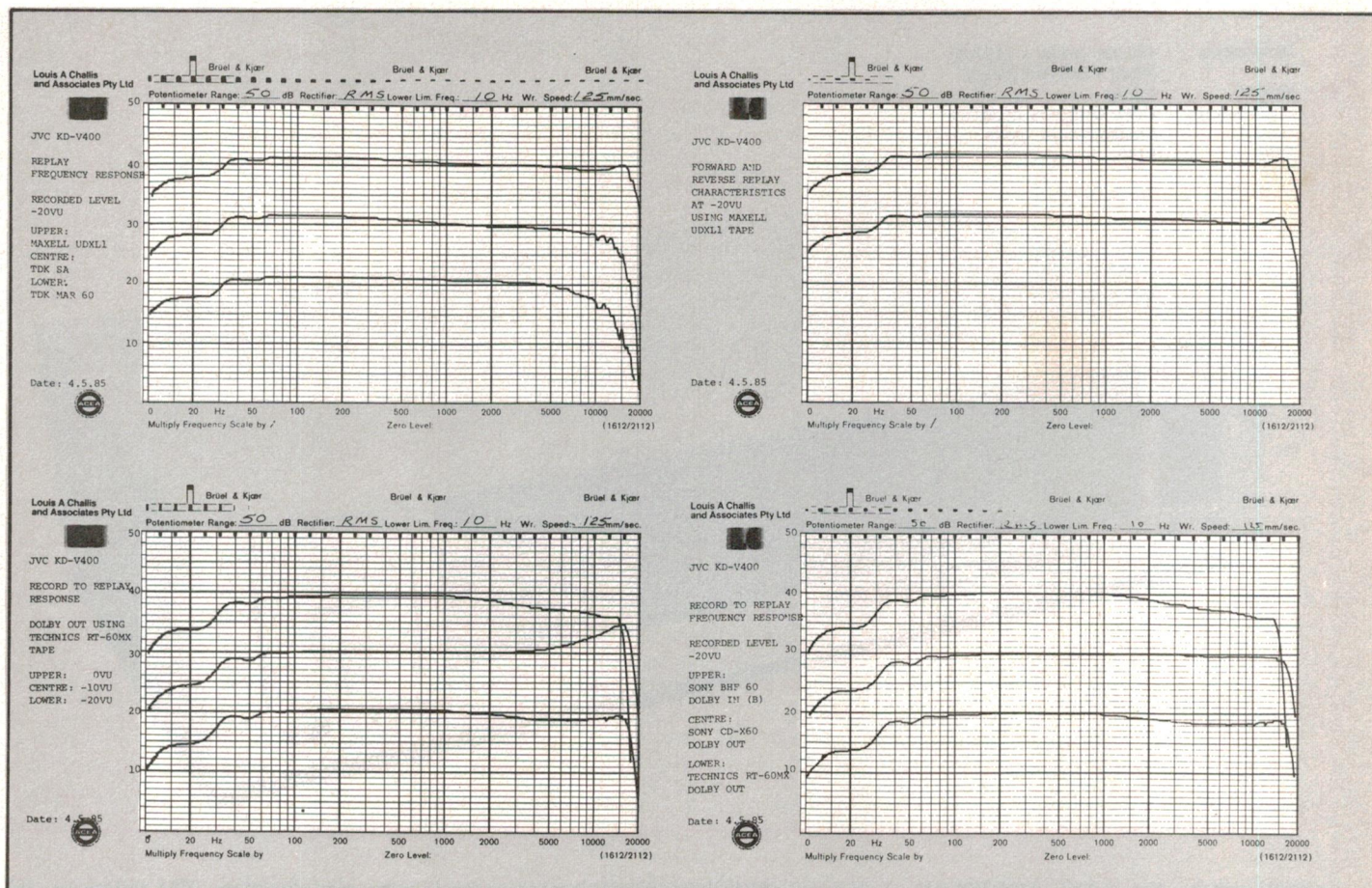
The objective performance of the unit displays excellent characteristics which firstly show up in the replay test. On gamma ferric oxide tape the frequency response extends from 13 Hz to 17 kHz +1 dB, -3 dB, with chrome equivalent tape, from 13 Hz to 10 kHz, and with metal tape from 25 Hz to effectively 10 kHz, when using our reference tapes. This performance does not materially change between forward and re-

verse play directions. The differences between the three tapes are primarily the result of very minor differences between the azimuth alignments on the laboratory machines when compared with this machine. The measured replay results are nonetheless excellent and a credit to the machine.

The record to replay results provide truly outstanding results with frequency responses that extend from 30 Hz to 8 kHz +0, -3 dB with TDK type D tape (which is one of the least expensive quality type I tapes available). With Sony CD Alpha 60 tape (a chrome equivalent), the frequency response is 32 Hz to 17.5 kHz +0, -3 dB with a ruler flat response between 100 Hz and 15 kHz, whilst with Technics RT-60 MX type IV (metal) tape, the frequency response is 32 Hz to 17 kHz +0, -3 dB. These results are about as good as you could reasonably ask for and more than good enough for a normal consumer who seeks above average performance without having to pay with 'an arm or a leg'.

The frequency response measured with Sony BHS 60 at 0, -10 and -20 VU shows how flat the frequency response of the recorder really is and indicates this is a machine which provides a linearity which any serious enthusiast would desire.

The third octave band analyses of signal-to-noise ratio with Dolby out, Dolby B and Dolby C activated reveal a performance which is extremely commendable. The A-weighted dynamic ranges are 61 dB with Dolby out, 70 dB with Dolby B and 78 dB



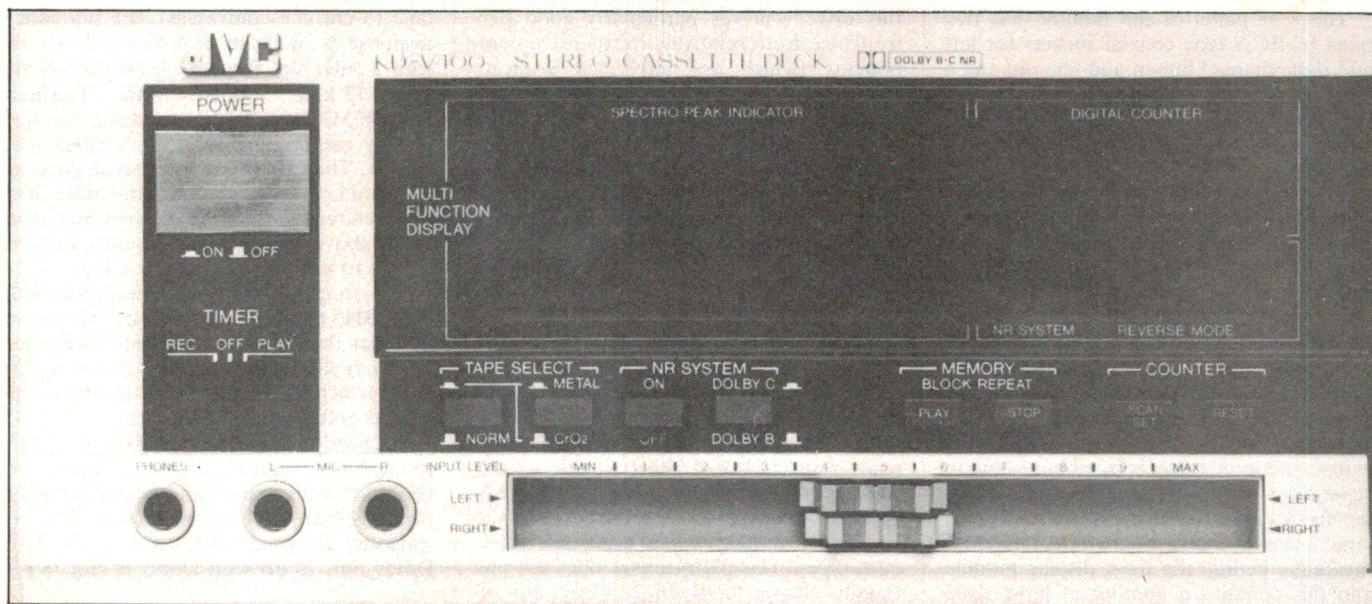
with Dolby C. This order of performance with Dolby C selected is approaching that provided by PCM recorders and only a little 18-20 dB below the best performance provided by CD players and stereo hi-fi video recorders. The difference in price of this recorder and the other recorders will not, however, escape your attention.

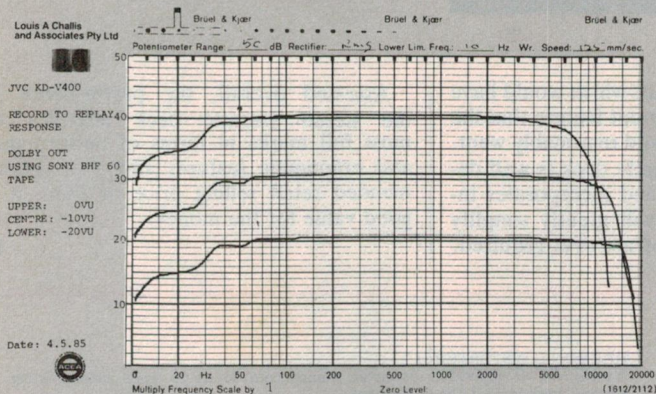
The wow and flutter figures are extremely good with 0.05% peak-to-peak

wow and only 0.055% weighted flutter. These again are better than you would expect from such a moderately priced machine. The reason for this, of course, is a direct result of the choice of the two large capstan drive pulleys which materially assist the reduction of both wow and flutter.

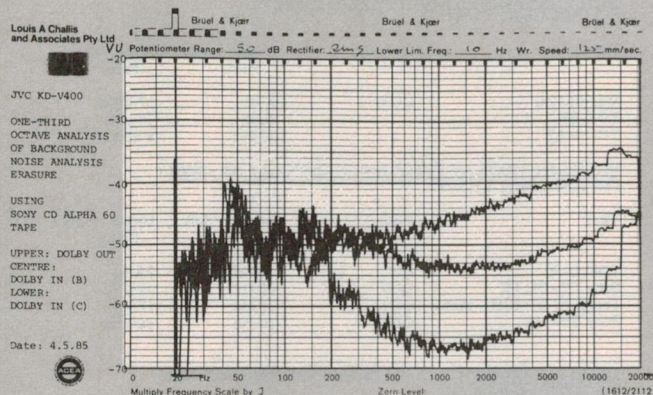
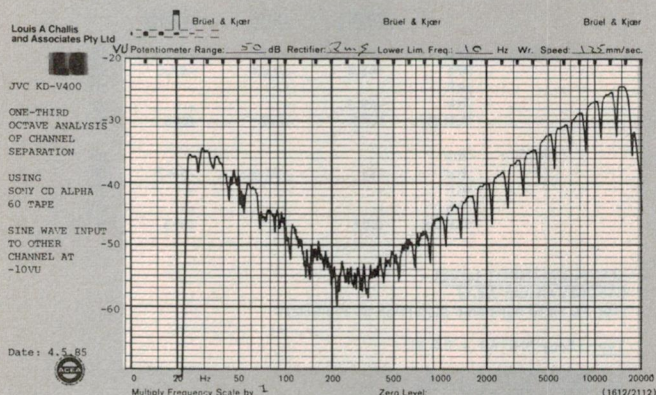
The distortion characteristics are extremely good and the level of distortion at 0 VU is only a modest 0.7% at 100 Hz,

0.68% at 1 kHz and 0.45% at 6.3 kHz. At -6 VU these figures are even lower being 0.09% at 100 Hz, 0.24% at 1 kHz and 0.33% at 6.3 kHz. The maximum input level for 3% third harmonic distortion at 333 Hz with Sony BHF 60 tape is +10 VU which is very commendable. Last but not least, the erasure ratio at 333 Hz is greater than 80 dB with Sony BHF 60 tape, and is -77 dB with Technics metal RT-60 MX





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tape. Overall, the objective performance of this recorder is particularly good and on a par with cassette recorders costing two to three times the price.

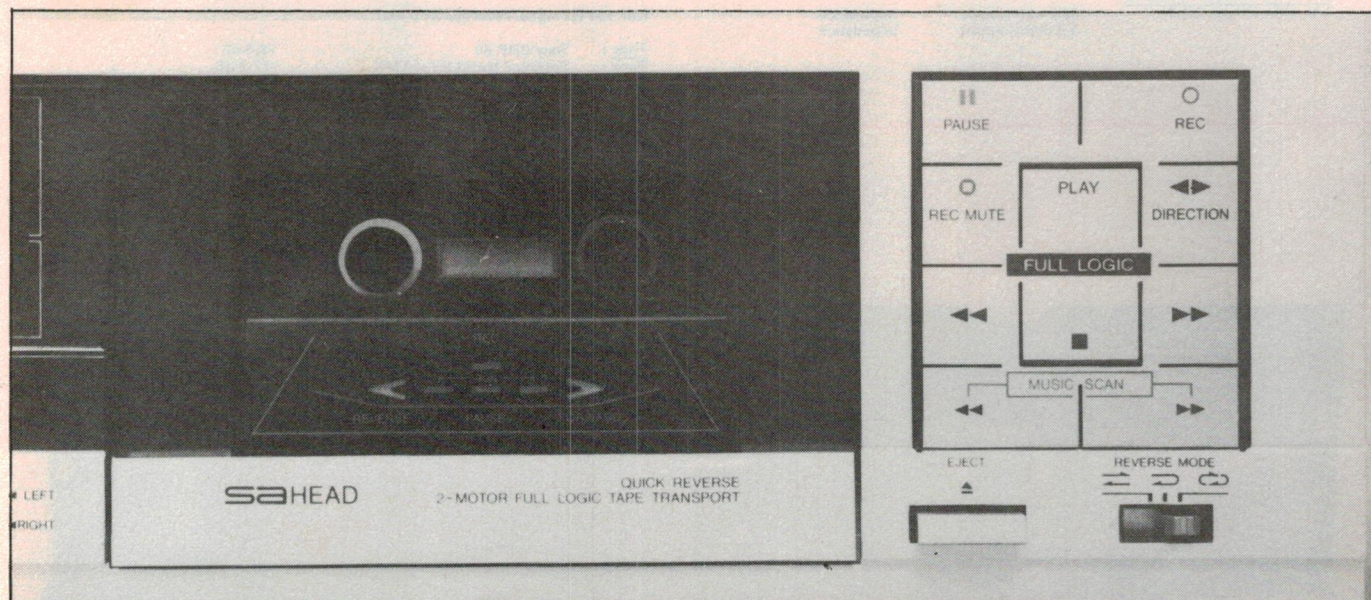
## Subjective testing

The subjective evaluation of the recorder proved to be a real pleasure. On replay with high quality pre-recorded cassettes you can really appreciate the benefits of both Dolby

B and Dolby C. With Dolby B there is the faintest trace of high frequency hiss still audible whilst with Dolby C there was virtually no trace of hiss detectable. I used the machine to temporarily record some high quality material from a CD disc so that I could replay it in order to perform an A-B comparison between the original and the re-recorded programme material. For this evaluation I used Sony BHF 60 and TDK

SA tapes which provided exemplary performance.

I experienced considerable difficulty in detecting which was the original and which was the re-recorded material with Dolby C encoding, but far less difficulty when using either Dolby B or when no noise reduction system was used. The Dolby C noise reduction system did however perceptibly alter the frequency balance on certain material



## SOUND REVIEW

and this was far more noticeable on voice and with recording instruments which do not contain very many inter-related harmonic components, ie with organs, horns, flutes and bells.

The one feature that I did miss with this recorder was the lack of a volume control

on the headphone circuit which would have provided the last important feature that the intending purchaser could reasonably want.

The KD-V400A cassette deck is well designed, well executed and incorporates internal features which will greatly simplify repairs when and if they are ever required.

Assessed overall, the performance of the stereo cassette deck achieves almost full marks in terms of performance and ergonomic features and at a recommended retail selling price of \$449, it is good value for the money.

### MEASURED PERFORMANCE OF J.V.C. MODEL KD-V400 TAPE RECORDER

SERIAL NO. 17960034

#### REPLAY FREQUENCY RESPONSE AT -20VU : (AS 2680 Clause 2.2.3.1)

Tape	Dolby	Lower - 3dB Point	Upper - 3dB Point
Maxell C60	OUT	7 Hz	17 kHz
TDK SA		5 Hz	14 kHz
TDK MAR		11 Hz	9 kHz

#### RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU : (AS 2680 Clause 2.2.3.1)

Tape	Dolby	Lower - 3dB Point	Upper - 3dB Point
TDK D-90	IN	30 Hz	7 kHz
Sony CD-OC 60	OUT	33 Hz	17 kHz
Technics RT-60MX Metal	OUT	33 Hz	17 kHz
Sony BHF-60	OUT	30 Hz	16 kHz

SPEED ACCURACY : -1.75% with TDK Reference tape  
(AS 2680 Clause 2.2.1)

#### WOW AND FLUTTER : (AS 2680 Clause 2.2.2)

WOW :	Average	0.05% peak to peak
FLUTTER :	Unweighted	0.09% RMS
	Weighted	0.055% RMS

#### SEPARATION (CROSS TALK) @ (AS 2680 Clause 2.2.7)

250 Hz	1 kHz	12.5 kHz
-65	-58	-36

#### MAXIMUM START TIME TO RECORD OR REPRODUCE : (AS 2680 Clause 2.3.1)

Play	less than 1.0 second
Record	less than 1.0 second

#### INPUT/OUTPUT SOCKETS (AS 2680 Clause 2.3.2)

80 k ohms input	impedance
5 k ohms output	impedance

### HARMONIC DISTORTION :

Assessment of individual harmonic components so as to avoid incorporating random noise level in the assessment.

#### Tape :

		100Hz	1kHz	6.3kHz	
0VU :	2nd	-	-	-	dB
	3rd	-43.2	-43.4	-47.0	dB
	4th	-	-	-	dB
	5th	-59.3	-	-	dB
	T.H.D.	0.70	0.68	0.45	%
-6VU :	2nd	-	-	-	dB
	3rd	-61	-53.3	-49.7	dB
	4th	-	-	-	dB
	5th	-	-	-	dB
	T.H.D.	0.09	0.24	0.33	%

### MAXIMUM INPUT LEVEL :

(AS 2680 Clause 2.2.6)  
(for 3% third harmonic distortion at 333 kHz)

Tape : Sony BHF 60 +10.0 VU

### MAXIMUM OUTPUT LEVEL :

(AS 2680 Clause 2.2.3)

0.36 volts for 0 VU at 1 kHz  
0.93 volts for +10VU at 1 kHz.

### EQUALISATION :

(AS 2680 Clause 2.3.6)

Is in accordance with IEC 268-3B

### DYNAMIC RANGE :

(AS 2680 Clause 2.2.6)

#### Tape : Sony BHF 60

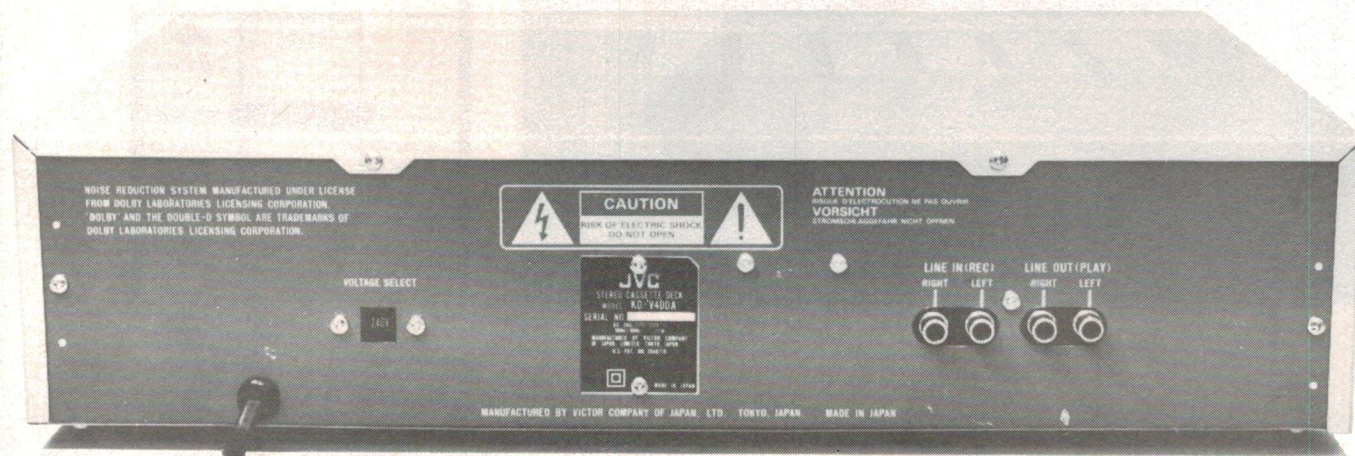
Dolby Out	57.5 dB(Lin)	61.0 dB(A)
Dolby B	64.0 dB(Lin)	70.0 dB(A)
Dolby C	70.0 dB(Lin)	78.0 dB(A)

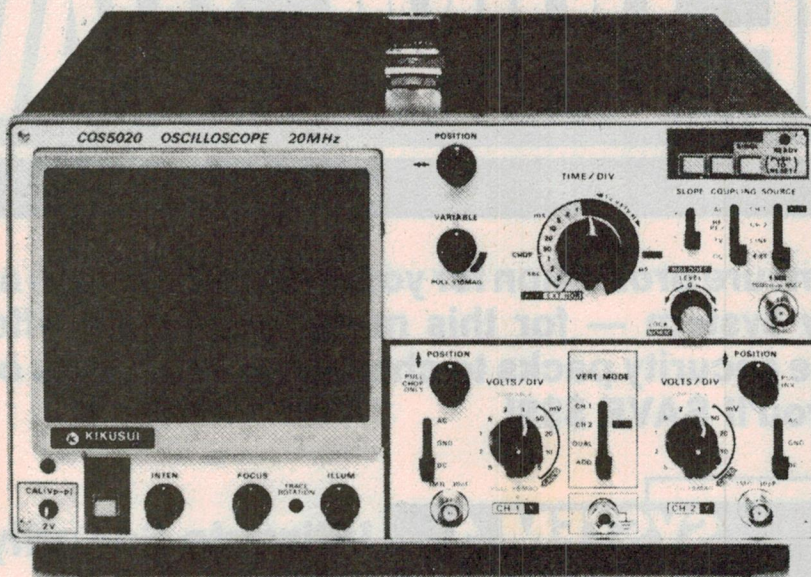
### ERASURE RATIO :

(AS 2680 Clause 2.2.8)

(for 333 Hz signal recorded at 0 VU)

Tape :	Sony BHF 60	78.0 dB
Tape :	Technics Metal RT-60 MX	-77.2 dB





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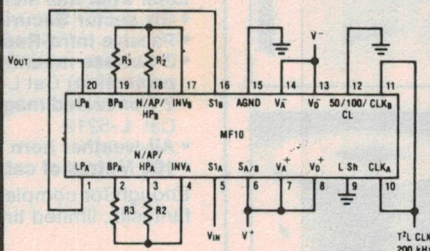
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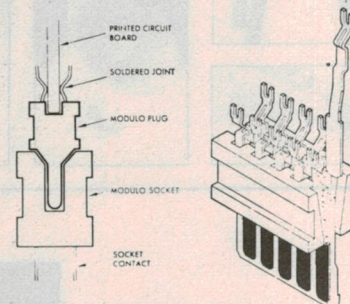
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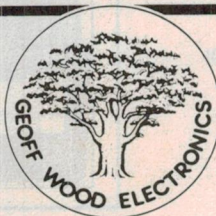
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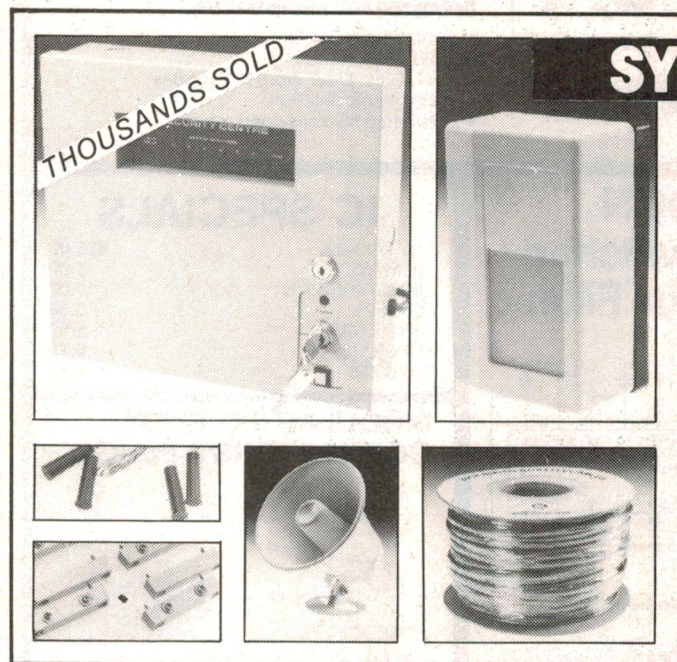


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## SYSTEM 3

## Budget Security

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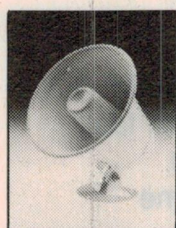
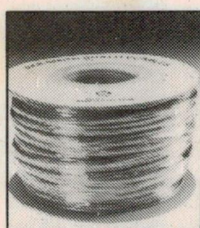
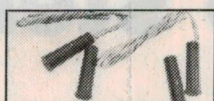
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ETI August 1985 — 27

# OPERATION MADE SIMPLE

## — TEAC R-555 stereo cassette deck

Incorporating some appealing operating innovations for the laid-back user such as auto reverse and blank scan fast forward, the R-555 promised to be a delight to the disinterested knob fiddler. And so it is . . . with some compromises.

**Louis Challis**

ONE OF THE current trends in design philosophy for high fidelity equipment is to design equipment which 'thinks for itself' so that the user is spared the problem of having to involve him or herself in any more than the bare essentials of switching on, switching off and maybe sometimes adjusting the volume control.

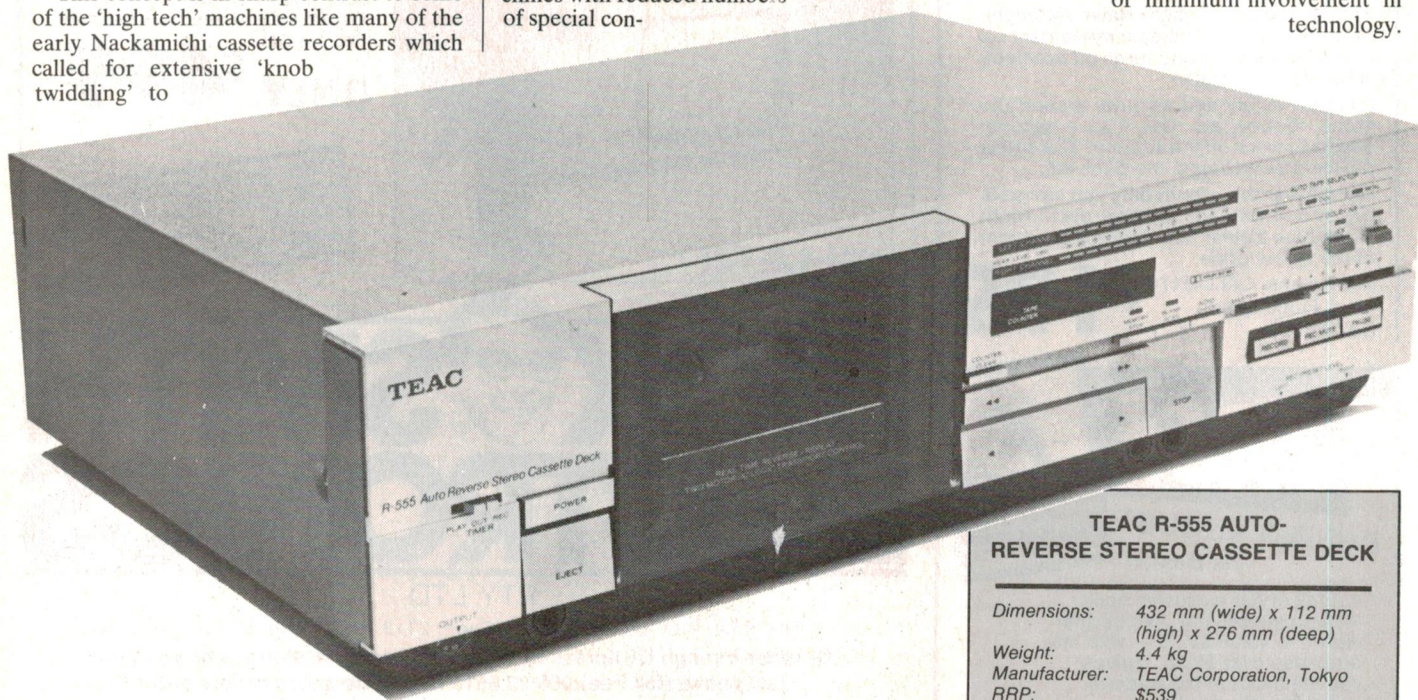
This concept is in sharp contrast to some of the 'high tech' machines like many of the early Nakamichi cassette recorders which called for extensive 'knob twiddling' to

achieve the ultimate in record or replay performance.

The trends are readily observable on the shelves of your high fidelity equipment retailer's shop. The 'high tech' machines providing copious quantities of knobs, buttons and special adjustments are there, and then there are the 'low key' — high tech' machines with reduced numbers of special con-

trols, no need to select equalization or type of tape being played and which generally look like 'bare bones' machines.

Now, looks can be deceiving and the TEAC R-555 auto-reverse stereo cassette deck is a good example of the extent to which the Japanese manufacturers have gone in order to pander to consumer tastes of 'minimum involvement' in technology.



**TEAC R-555 AUTO-REVERSE STEREO CASSETTE DECK**

Dimensions: 432 mm (wide) x 112 mm (high) x 276 mm (deep)  
Weight: 4.4 kg  
Manufacturer: TEAC Corporation, Tokyo  
RRP: \$539

## On the outside

The front panel of the R-555 is predominantly brushed satin aluminium with black lettering. On the left-hand side of the deck is a relatively small POWER (ON/OFF) switch with a very large and sensible EJECT button immediately below.

To the left of these is a TIMER SWITCH to facilitate automatic unattended play or recording with an associated electrical time clock. Recessed underneath these controls is a standard tip ring and sleeve socket for headphones; this has sensibly been provided with a volume control thumb-wheel knob. To the right of this is a clear acrylic cassette well cover which is smoothly damped for opening and closing. This accepts the cassette into side guides before manually closing the door. The cassette drive features two separate motors with IC logic for controlling the tape transport system. These provide the ability to automatically reverse and replay without removing the cassette or turning it over.

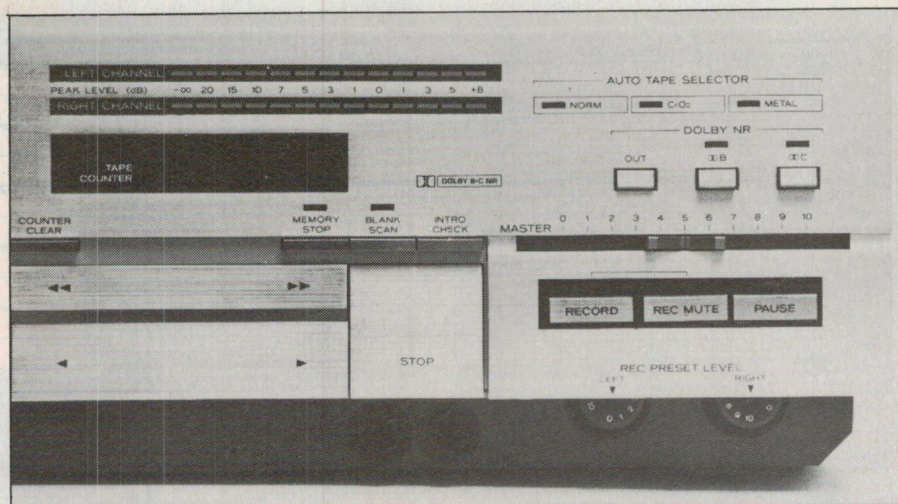
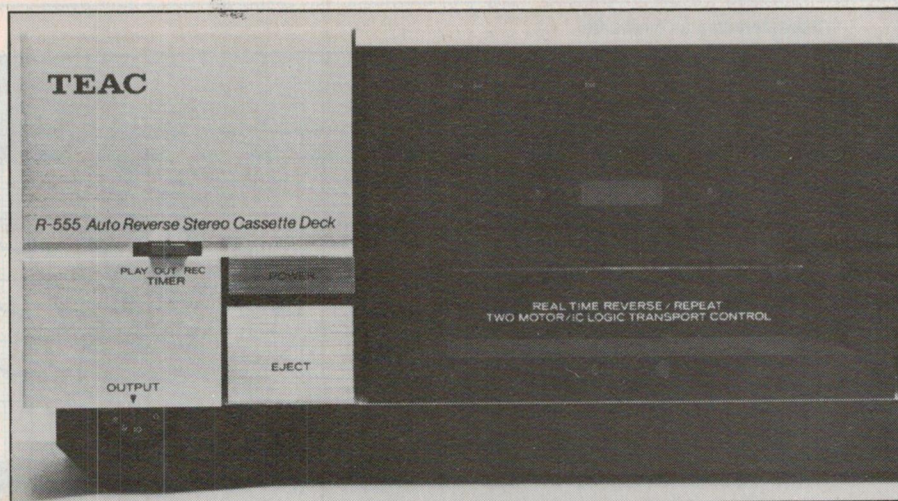
At the top right-hand of the front panel are two peak reading light emitting diode displays with 13 discrete steps covering the range 0 to +8 dB, with green LEDs used for 20 to -1 dB and red LEDs for 0 to +8 dB. To the right of this are three separate LEDs to indicate the automatic selection of type I (gamma ferric oxide), type II (chrome or chrome equivalent tapes) or type IV (metal) tapes. This is a process over which you have no control and about which I will have more to say later. Below these displays is a four digit counter using large green LEDs in the numerical display. To the right are three switches for selecting DOLBY OUT, DOLBY B or DOLBY C noise reduction system.

In the next row of controls is a small switch for resetting the counter; a MEMORY STOP button, which is pressed during recording or replaying and will allow you to return to that precise position on the tape during either high speed fast forward or rewind as well as during play; and a BLANK SCAN button which, when selected, allows you to skip over any blank or unrecorded segment on the tape of a duration of greater than 10 seconds. After the skip the cassette will continue to play normally. An INTRO CHECK button allows you to preview the first 10 seconds of every recorded track on the tape.

On the right hand side of this is a single, ergonomically well designed VOLUME control into which your thumb or finger neatly fits to exercise very positive control.

On the lower edge of the front panel adjacent to the cassette well are two long rocker bars: the upper one being marked with double arrows for FAST FORWARD and FAST REWIND and the lower one being marked with single arrows to indicate FORWARD or REVERSE play.

Between these two sets of controls, the designers have placed a translucent plastic strip which is illuminated at one end by a soft green light. This clearly indicates the direction of tape travel and flashes when the



STOP button is actuated or selected. During the record mode the green colour changes to red.

Three other switches are provided on the right hand side of the deck. One is a RECORD button, which if activated after STOP has been selected, automatically and in less than one second, starts recording. A RECORD MUTE button when selected in the recording mode, provides a blank section of tape for 4.5 seconds before placing the recorder in the PAUSE mode. It is then necessary to press the last of the three controls, namely PAUSE, to return the recorder to the normal recorder process after a short delay associated with the electronic controls.

On the recessed lower edge of the front panel are two sockets for microphones and a pair of preset thumb wheels for separately adjusting the individual recording levels for left and right channels.

The rear panel of the unit is particularly sparse with only two pairs of RCA coaxial sockets for LINE INPUT and LINE OUTPUT and a double insulated mains lead for 240 volt power supply.

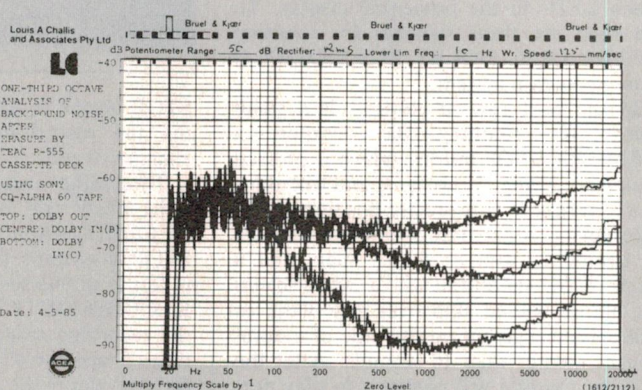
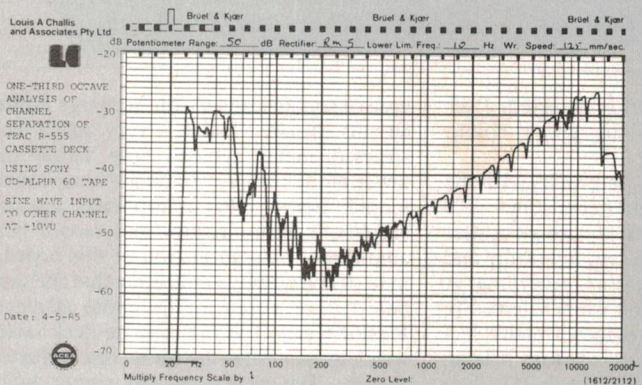
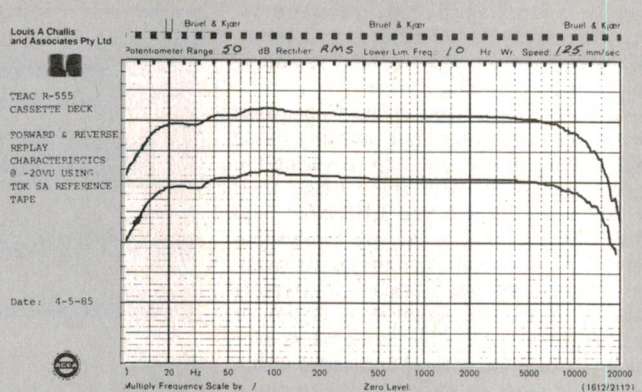
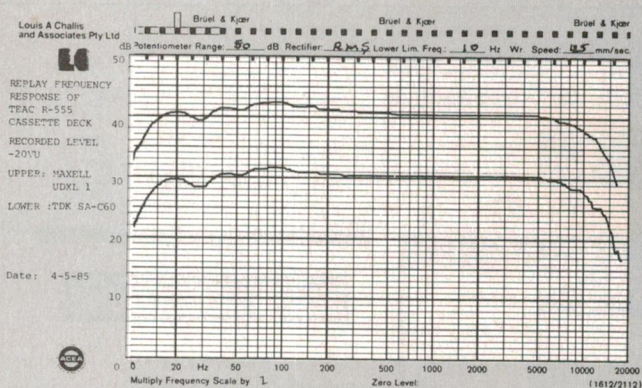
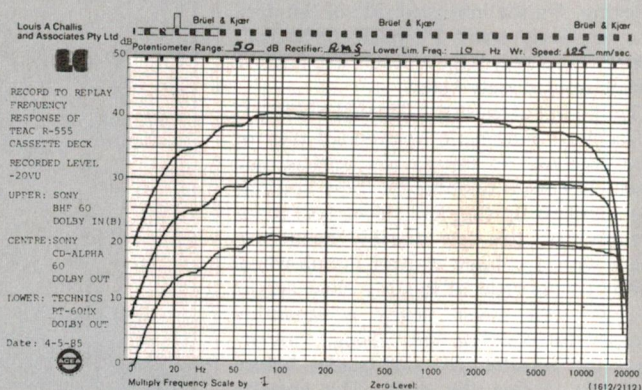
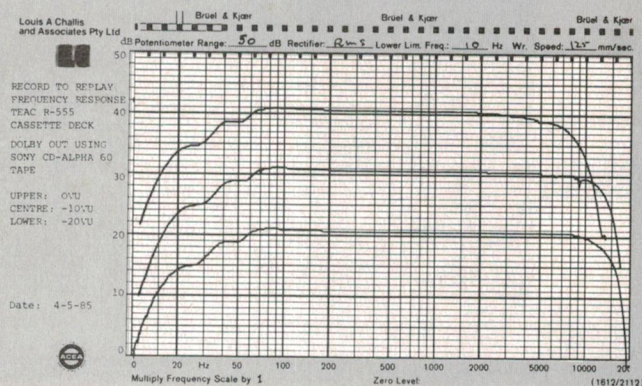
## On the inside

With the metal lid removed, you soon see how the designers have achieved a high de-

gree of sophistication with two large printed circuits installed inside a very lightly constructed metal cabinet. The larger and lower of the two printed circuit boards is the mother board. This incorporates the pre-amplifier's bias circuitry and record head amplifiers. A large section of this board is bare of components indicating that the same board is also used for the more advanced R-666X version of the cassette deck series, which incorporates the dBX noise reduction system. The upper printed circuit board which contains the IC logic and display module controls is connected to the lower board by neat extended length ribbon cables. Much to my surprise these have been made long enough to allow the board to be easily removed and placed outside the cabinet whilst still providing full electrical connections and still fully functional. This is a much more sensible approach than that taken by most other manufacturers, who require their service centres to have special extender boards or extension cables.

The cassette drive mechanism is well executed with internal ribbon cable connections to the heads, neatly manufactured combinations of plastic and metal in the construction. The drive incorporates precision motors and capstan assemblies which are capable of achieving very low wow and ▶

## Characteristics as measured.



flutter performance. The whole unit has been designed in such a way that maintenance, if or when required, will be very simple. It also exemplifies the degree of service oriented sophistication which some Japanese designers and manufacturers are now currently incorporating in consumer electronics.

## Testing

The testing of the R-555 cassette deck proved to be a little more complex than I expected. This complication was not due to any 'real fault' in the machine so much as to an historical enigma associated with our pre-recorded reference tapes. Some of these, and most notably the metal replay reference tape, were produced prior to the

standardization of the format for automatic tape detection, which is an essential requirement for correct tape detection with a fully automatic cassette recorder like this one. In simple terms this meant that I could only measure the replay characteristics of this cassette recorder with a type I and type II tape but not with a type IV tape. The replay characteristics were +2, -3 dB from 15 Hz to 11 kHz with both type I and II tapes. The limited high frequency response is primarily a function of the azimuth alignment reference tapes used by TEAC which are measurably different from those which we use (TDK AC-323 and AC-324). These differences are typical of many machines we have recently reviewed. We evaluated the replay characteristics in both the forward

and reverse play directions. As I expected, I was able to discern the difference with approximately 0.5 kHz difference in the overall bandwidth at the -3 dB point. This is due to the extremely small differences in azimuth alignment which occurs during the transitory movement of the heads between forward and reverse play directions.

The record to replay characteristics of this cassette deck are highly commendable. At -20 VU with type II tapes and with metal tapes, the response is almost ruler flat from 70 Hz to 10 kHz and still quite acceptable at frequencies in the range of 10-17 kHz. The automatic equalization selection soon showed itself to be better suited to some tapes than others. Maxell UDXL1 thus appears to be a more appropriate tape

than Sony BHF 60 or TDK-D90. By contrast the Sony CD Alpha 60 tape provides a much flatter response than BASF CD-SP II.

The speed accuracy was 1% slow, whilst the wow and flutter characteristics were reasonably good with an unweighted flutter figure of 0.12% rms and a weighted flutter figure 0.08% rms. The distortion characteristics of 0 VU were higher than 1% at each test frequency, but were well controlled at -6 VU where they were less than 0.5%. The reasons for these levels being slightly higher than normal apparently relate to the operating point chosen for the arbitrary selection of the 0 VU point. This results in a 3% third harmonic distortion at 333 Hz of only +3 VU with type I tape. As a consequence of this selection, the dynamic range of the machine is 56 dB(A) with Dolby out, 64.5 dB(A) with Dolby B and 72.5 dB(A) with Dolby C. This dynamic range performance is reasonably good, but is not as high as I would like to achieve for maximum hiss reduction in either the Dolby B or Dolby C modes of operation.

The erasure ratio of the cassette recorder is reasonably good with greater than 80 dB of erasure for a type I tape and fully acceptable 74 dB erasure ratio for a type IV (metal) tape. The time required to initiate full recording or playback modes is of the order of 1 second and even occurs when transposing the heads from pause to play or during pause to record. This time delay would unquestionably prove too long for most serious amateur recordists.

The maximum output level at 0 VU is 450 millivolts whilst the maximum output level

at +8 VU is 900 millivolts and the extent of tape saturation in the +3 to +8 VU domain is higher than I have seen in any other cassette recorder in recent years.

During an extended subjective evaluation of the cassette deck at home, I became aware of a number of minor idiosyncrasies. The first is associated with the time that the recorder takes to transpose the head mechanism into the record mode from either pause or from stop. This time is controlled entirely by the logic circuitry and the associated motorized actuation system. Whilst only 1 second in duration, it was nonetheless a perceptibly longer period than that of most other cassette recorders with which I am familiar. The second idiosyncrasy is the lack of the +10 VU setting on the peak reading recording level display which I would normally expect in using a metal tape. The designers have chosen a lower peak level, because the absolute distortion is already well and truly unacceptable at +8 VU.

The third minor criticism related to my inability to correctly record on or replay type II (chrome or chrome equivalent) or type IV (metal) tapes if they are not current generation tapes with conforming cassette housings incorporating appropriate slots on the rear of the casing. This initially proved to be a little disconcerting as I have a large number of commercially pre-recorded tapes which could not be used.

The last of my observations related to the recording of material so as to have no significant audible difference between the original and the recorded content. With

## SOUND REVIEW

no Dolby or with Dolby B noise reduction in use and with type I or type II tapes, the level of hiss and the modification of spectral content made it all too easy to pick the difference between the original and the recordings. With Dolby C noise reduction with type II tapes, I could still hear the difference, even if it was more difficult. With Dolby C and type IV tapes any task was markedly more difficult and the cassette recorder performed exceptionally well.

Apart from those gripes, I found this recorder in all other respects delightfully easy to use, and the functional controls were large, sensible and better than that provided by most other auto-reverse stereo cassette decks currently available.

One feature that the deck does not offer which most other decks provide is the selection of single or multiple cycles between forward and reverse directions under automatic control. This omission may discourage a few intending purchasers from buying what is otherwise a reasonably well designed cassette deck.

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### MEASURED PERFORMANCE OF TEAC R-555 AUTO-REVERSE STEREO CASSETTE DECK

Serial No. 4852 020791

#### REPLAY FREQUENCY RESPONSE AT -20VU: (AS 2680 Clause 2.2.3.1)

Tape	Dolby	Lower - 3dB Point	Upper - 3dB Point
Maxell C60	OUT	13 Hz	11 kHz
TDK SA		13 Hz	11 kHz
Metal		Incompatibility of test tape with auto function	

#### RECORD TO REPLAY FREQUENCY RESPONSE AT -20VU: (AS 2680 Clause 2.2.3.1)

Tape	Dolby	Lower - 3dB Point	Max. Point & Frequency	Upper - 3dB Point
Sony BHF-60	(B) IN	36 Hz	0.5 dB 90 Hz	9.0 kHz
Sony CD-Alpha 60	OUT	36 Hz	0.5 dB 90 Hz	14.0 kHz
Technics RT-60MX	OUT	36 Hz	0.5 dB 90 Hz	17.0 kHz
Metal				

#### SPEED ACCURACY: (AS 2680 Clause 2.2.1)

-1.0% with TDK Reference tape

#### WOW AND FLUTTER: (AS 2680 Clause 2.2.2)

WOW:	Average	0.05% peak to peak
FLUTTER:	Unweighted	0.12% RMS
	Weighted	0.08% RMS

#### SEPARATION (CROSS TALK) @ (AS 2680 Clause 2.2.7)

250 Hz	1 kHz	12.5 kHz
-55 dB	-45 dB	-27 dB

#### MAXIMUM START TIME TO RECORD OR REPRODUCE: (AS 2680 Clause 2.3.1)

Play	less than 1.0 second
Record	less than 1.0 second

#### INPUT/OUTPUT SOCKETS (AS 2680 Clause 2.3.2)

Input Impedance:	40 k ohms
Output Impedance:	2 k ohms

#### HARMONIC DISTORTION:

Assessment of individual harmonic components so as to avoid incorporating random noise level in the assessment.

Tape: Sony CD Alpha 60

		100Hz	1kHz	6.3kHz	
0 VU:	2nd	-45.1	-44.6	-41.0	dB
	3rd	-38.4	-39.4	-42.7	dB
	4th	-60.8	-58.3	-58.7	dB
	5th	-66.7	-	-	dB
	T.H.D.	1.33	1.23	1.16	%
-6 VU:	2nd	-50.8	-53.3	-	dB
	3rd	-55.0	-48.9	-50.8	dB
	4th	-62.1	-57.7	-	dB
	5th	-62.9	-	-	dB
	T.H.D.	0.35	0.44	0.29	%

#### MAXIMUM INPUT LEVEL:

(AS 2680 Clause 2.2.6)  
(for 3% third harmonic distortion at 333 kHz)

Tape: Sony CD-Alpha 60 +3.0 VU

#### MAXIMUM OUTPUT LEVEL:

(AS 2680 Clause 2.2.5)  
(metal tape) 0.49 Volts for 0 VU at 1 kHz  
1.18 Volts for +10VU at 1 kHz.

#### EQUALISATION

(AS 2680 Clause 2.3.6) Is in accordance with IEC 268-3B

#### DYNAMIC RANGE: (AS 2680 Clause 2.2.6)

Tape: Sony CD-Alpha 60

Dolby Out	52.0 dB(Lin)	56.0 dB(A)
Dolby B	56.0 dB(Lin)	64.5 dB(A)
Dolby C	58.0 dB(Lin)	72.5 dB(A)

#### ERASURE RATIO:

(AS 2680 Clause 2.2.8)  
(for 333 Hz signal recorded at 0 VU)

Tape: Sony CD-Alpha 80	> 80.0 dB
Tape: Technics RT-60 MX	-74.2 dB

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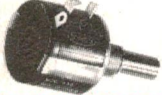


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1-9 10-99 100+  
**\$0.10 \$0.09 \$0.08**



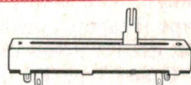
### VIDEO RF MODULATOR

At an unbelievable price!  
Our RF modulators are channel selectable either Channel 0 or Channel 1. Cat. S16040  
1-9 **\$4.95 \$3.95**



### 10 TURN WIRE WOUND POTENTIOMETER

**Spectrol Model 534** 1/4" shaft.  
Equiv. (Bourns 3540S, Beckman 7256)  
Dials to suit 16-1-11, 18-1-11, 21-1-11.  
R14050 50R R14100 5K  
R14055 100R R14110 10K  
R14060 200R R14120 20K  
R14070 500R R14130 50K  
R14080 1K R14140 100K  
R14090 2K  
1-9 10+  
**\$9.50 \$8.50**



### LOG SLIDES POTS

We ordered log instead of linear for the graphic equalizer, so take advantage!  
1-9 10+ 100+  
**\$0.65 \$0.60 \$0.50**



### SPECTROL 43P

Equiv. (Bourns 3006)  
Great for precision work.  
R14200 10R R14290 10K  
R14210 20R R14300 20K  
R14220 50R R14310 50K  
R14230 100R R14320 100K  
R14240 200R R14330 200K  
R14250 500R R14340 500K  
R14260 1K R14350 1M  
R14270 2K R14360 2M  
R14280 5K  
1-9 10+  
**\$1.10 \$1.00**



### 4SP TRIMPOTS

1-9 10+  
**\$1.10 \$1.00**

## CONNECTORS!



### RS232 & 'D' TYPE CONNECTORS

PART	DESCRIPTION	CAT. No.
1-9		
DE 9P	9 Pin Female	P10880
<b>\$1.75</b>		<b>\$1.60</b>
DE 9S	9 Pin Male	P10881
<b>\$2.25</b>		<b>\$2.45</b>
DE 9C	9 Pin Cover	P10992
<b>\$2.55</b>		<b>\$2.45</b>
DA 15P	15 Pin Male	P10894
<b>\$2.10</b>		<b>\$1.95</b>
DA 15S	15 Pin Female	P10895
<b>\$2.25</b>		<b>\$2.10</b>
DA 15C	15 Pin Cover	P10892
<b>\$1.15</b>		<b>\$1.05</b>
DB 25P	25 Pin Male	P10900
<b>\$2.95</b>		<b>\$2.80</b>
DB 25S	25 Pin Female	P10901
<b>\$3.45</b>		<b>\$3.30</b>
DB 25C	25 Pin Cover	P10902
<b>\$1.20</b>		<b>\$1.10</b>



### 36 WAY CENTRONICS CRIMP PLUG

Cat. P12200  
1-9 10-99 100+  
**\$7.95 \$7.50 \$7.25**



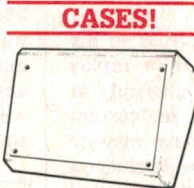
### SOLDER CENTRONICS PLUGS

Unreal price for absolute top quality. Normally \$14.95 (Our opposition charge up to \$19.95).  
1-9 10+ 100+  
**\$6.50 \$5.95 \$4.95**



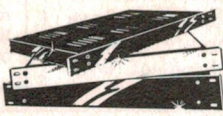
### IC SOCKETS (LOW PROFILE)

How cheap can they go?  
1+ 10+ 100+ 1000+  
8 Pin Cat. **15c 14c 12c 09c**  
14 Pin Cat. **16c 15c 14c 10c**  
16 Pin Cat. **17c 16c 15c 11c**  
18 Pin Cat. **18c 17c 16c 13c**  
20 Pin Cat. **29c 28c 27c 26c**  
24 Pin Cat. **35c 33c 32c 28c**  
40 Pin Cat. **45c 40c 35c 30c**



### NEW SLOPING CASES

Plastic with metal front panel, available in two sizes:  
Cat. H10450 190x120mm **\$9.95**  
Cat. H10455 256x185mm **\$17.95** (measurements are approx. only)



### PROFESSIONAL SERIES RACK MOUNTING CABINETS

These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance:  
• All aluminium construction.  
• Removeable top and bottom panels.  
• All dimensioning conforms to the International Standard.  
• Natural or black finish.  
• Ventilated lid.  
• Deluxe brushed finish anodised front panel.

	1-4	5+
H10401 Natural	<b>\$49.50</b>	<b>\$43.50</b>
H10402 Natural	<b>\$55.50</b>	<b>\$49.50</b>
H10403 Natural	<b>\$62.50</b>	<b>\$55.50</b>
H10411 Black	<b>\$49.50</b>	<b>\$43.50</b>
H10412 Black	<b>\$55.50</b>	<b>\$49.50</b>
H10413 Black	<b>\$62.50</b>	<b>\$55.50</b>



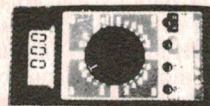
**ECONOMY 19" RACK CASE**  
Tremendous Value! Dimensions W 480 x H 134 x D 250mm.  
Cat. H10400 1-9 10+  
**\$34.95 \$29.50**

## TOOLS OF TRADE!



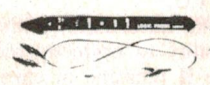
### WELLER WTCPN SOLDERING STATION

The WTCPN Features:  
• Power Unit 240 V AC  
• Temperature controlled iron, 24 V AC  
• Flexible silicon lead for ease of use  
• Can be left on without fear of damaged tips!  
The best is always worth having.  
Cat. T12500 **Normally \$97.50 NOW \$87.50**



### WE HAVE DONE IT AGAIN!

New multimeter at unbeatable value for under \$45! The new **YU-FONG YFE-1030C** features:  
• Large 3 1/2 digit display. (1 1/2 inch high)  
• Autopolarity, "-" display for Negative input.  
• High over-load protection for all ranges.  
• Over-load display highest figure "1" or "1" alone glows.  
• Power consumption 20mW approx.  
Cat. **\$49.95**



**LOGIC PROBE 3800A**  
Features 20MHz memory. TTL/CMOS operation. Normally \$29.50  
Cat. Q11272  
1-9 10+  
**\$23.50 \$19.50**



### DIGITAL MULTIMETER

YFE YF1100 FEATURES:  
• Large easy to read 3 1/2 digit display  
• Facilities for transistor and diode testing  
• Clearly laid out front panel  
• 10A DC AC range  
• Priced to undersell the others  
Cat. Q16025 **\$79.50**

## IC's GALORE!



### IC SPECIALS!

	1-9	10+	100+
4116	<b>\$1.80</b>	<b>\$1.70</b>	<b>\$1.60</b>
4164	<b>\$3.25</b>	<b>\$2.95</b>	<b>\$1.95</b>
2716	<b>\$5.90</b>	<b>\$5.50</b>	<b>\$5.50</b>
2732	<b>\$6.25</b>	<b>\$5.95</b>	<b>\$5.50</b>
2764	<b>\$8.25</b>	<b>\$7.95</b>	<b>\$6.00</b>
27128	<b>\$12.50</b>	<b>\$11.50</b>	<b>\$7.50</b>
6116	<b>\$5.50</b>	<b>\$5.15</b>	<b>\$3.90</b>
41256	<b>\$14.50</b>	<b>\$12.50</b>	<b>\$10.00</b>
62648	<b>\$19.50</b>	<b>\$17.50</b>	<b>\$14.00</b>

### WORLD MODEM CHIP

Cat. **\$49.95**

## BATTERIES!

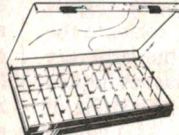


**NICAD CHARGES**  
Cat. **\$24.95**



**NICAD BATTERIES**  
Save on carbon batteries with these Apolcon Nickel cadmiums. Rechargeable up to 1000 times!  
1-9 10+  
Cat. S15020 **AA500 MA \$2.45**  
Cat. S15021 **C1.8 AH \$4.95**  
Cat. S15022 **D4 AH \$7.95**

## HARDWARE!



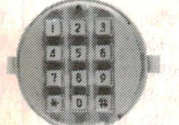
### UTILITY CASE

A must for all technicians, hobbyists and handy-men. Features clear plastic lid so you can tell at a glance the contents, up to 48 compartments, adjustable to suit your needs. A place for everything and everything in its place!  
Cat. H10449 **\$14.50**



### BULK CABLE 100M ROLLS

Cat. W11222 3C2V 75 OHM **\$22**  
Cat. W11224 5C2V 75 OHM **\$35**  
Cat. W11219 4 Core Shielded **\$49**



### PUSH BUTTON DIALLERS

Tired of old fashion dialling and re-dialling engaged numbers? These convenient push button diallers include last number redial (up to 16 digits) and instructions for an easy changeover.  
Cat. A12030 **\$19.95**



### U.V. TUBES

Fits into standard 15W fluoro holder. Suitable for Scotchcal, Epsom erasing etc. As used in ETI Epsom Erasing Kit.  
WARNING: Do not look directly into UV Tubes.  
Cat. H28600 **\$24.95**  
\*If ordering by mail please include an extra \$2 for "special" packing.

## TELEVISION ACCESSORIES!



### HYBRID SPLITTERS

**2 Way**  
• Input/Output 75 Ohm  
• Splitting loss 3.5dB  
• Isolation 25dB  
• V.S.W.R. 1.3  
Cat. L11310 **\$3.95**  
**4 Way**  
• Input/Output 75 Ohm  
• Splitting loss 6.8dB  
• Isolation 32dB  
• V.S.W.R. 1.3  
Cat. L11320 **\$5.95**



**300 OHM COUPLERS**  
Suitable for UHF, VHF and FM.  
**2 Set**  
Cat. L11300 **\$2.85**  
**4 Set**  
Cat. L11302 **\$4.90**



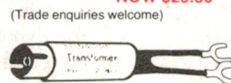
### UHF/VHF OUTDOOR MATCHING TRANSFORMER

75/300 Ohm. Waterproof type  
Cat. L11020 **\$3.75**



### UHF/VHF/FM ANTENNA

Frequency: VHF 48-216 MHz (Ch 1-12)  
UHF 536-764 MHz (Ch 25-62)  
Up grade your TV system now before Channel 0 disappears! Includes 75ohm and 300ohm balun, incredible value!!  
Impedance: 75/300 (200) Ohm  
Element: VHF 4, UHF 9  
Gain (dB): VHF 4-6, UHF 4-8  
Cat. L11014 **Normally \$39.50 NOW \$29.50**



### MATCHING BALUN TRANSFORMER

Female Type 75/300 Ohm  
Cat. L11010 **\$2.95**



### PLASTIC BODY CO-AXIAL CONNECTORS

Plug Cat. P10401 **\$0.50**  
Socket Cat. P10408 **\$0.60**

## CIRCUIT PRODUCTS!



### S100 PROTOBOARDS

Horizontal Buss Cat. H19125 **\$29.50**  
Vertical Buss Cat. H19130 **\$29.50**



### FULL STRENGTH FERRIC CHLORIDE

	1-9	10+
250ml	<b>\$1.95</b>	<b>1.75</b>
500ml	<b>\$2.95</b>	<b>\$2.50</b>
1 litre	<b>\$4.95</b>	<b>4.50</b>



### PC BOARDS

Make your own kits!

ET1478SA	1.85	ET1153	2.40
ET1478SB	1.65	84AU1	1.95
ET1478SC	1.65	ET1610	2.90
ET1478SD	1.65	ET1678	2.35
82A03B	2.80	80P66	5.10
81FM10A	6.95	81DC2	1.65
81FM10B	3.25	82GA5	2.10
ET11405A	2.40	84US6	2.65
ET11405B	3.60	ET1147	2.85
ET1478MC	2.50	ET1458	3.25
ET1478MM	2.50	ET1071	1.60
ET1755A	5.55	ET1485	3.60
ET1755B	1.80	81MC8	7.55
ET1755C	1.80	ET1480	2.85
84MA11	2.30	82IV6	6.55
82TA10	1.90	ET1163	6.05
ET1755B	1.95	ET1159	2.65
84EC11	8.30	ET1466	6.55
ET1477	6.95	ET1280	2.70
ET1668	3.75	ET1675	3.35
ET1494	2.55	ET1671	2.55
ET1471	11.90	84TP2	2.75
ET11421	2.75	84TP2	2.75
ET1585T	1.45	ET1268	1.35
ET1585R	1.80	ET1712	1.60
82IV6	6.55	83GA6	6.05
84TP2	2.75	84MS10	2.65
ET1480	2.85	ET1256	1.80
84PA11	3.75		

# at Rod Irving Electronics!

## SECURITY EQUIPMENT!

**AFTER STOCK TAKE SPECIAL! SAVE \$20!!**

### LOCAL BURGULAR ALARM CONTROL PANEL

The odds against you are climbing and prevention is better than cure!

- Adjustable exit/entry time delay and alarm time (avoids unnecessary noise pollution)
- 12V D.C. 1.5Amp
- Provision for battery back-up.
- Tamper switch
- Optional outputs: Sirens, bells, floodlights, automatic diallers, tape recordings, closed circuit TV, etc.
- Accepts N.C. and N.O. detectors such as infrared, microwave, ultrasonic, wireless, vibration sensor, magnetic switch, door mat, smoke detector, glass breakage sensor, panic button etc.

Cat. S15051 **Normally \$99.95 NOW \$79.95**

**AFTER STOCK TAKE SPECIAL! SAVE \$10!!**

### RITRON KEYLESS CAR ALARM

The first shipment sold out immediately to the trade. They didn't reach our own retail stores!

- Activated and disarmed by ignition key so you never forget to turn it on.
- Multi-function, built in siren or external siren, car signal horn output.
- Easy to install, no door switch required.
- Automatic reset after 60 seconds (avoids noise pollution)
- Special sensor protects Stereo or CB.
- 12V DC

Cat. S15054 **Normally \$39.95 NOW \$29.95**

**AFTER STOCK TAKE SPECIAL! SAVE \$10!!**

### ULTRASONIC BURGULAR ALARM

- Easy to install
- Connect with magnetic switch, infrared detector, etc.
- Equip with horn/speaker, lockswitch, flashlight, closed circuit TV, etc.
- Rechargeable battery circuit with recharge indicator L.E.D.
- N.O. and N.C. circuit breakdown indicator
- Low dry battery indicator

Cat. S15052 **Normally \$89.95 NOW \$79.95**

### MINIATURE BUZZER

5-15V White or black. Cat. A15062 **1-9 \$1.95 10+ \$1.75**



### HORN CRAZY!!

8W, aluminium or plastic. Normally \$9.50  
Aluminium Cat. C12015  
Plastic Cat. C12010  
**1-9 \$6.50 10+ \$5.95**

## VIDEO ACCESSORIES!



### TDK VIDEO TAPES AT BARGAIN PRICES!

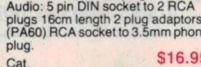
VHS:	E60	\$12.50
	E120	\$12.50
	E180	\$11.80
	E240	\$22.40
BETA:	L250	\$13.50
	L500	\$14.40
	L750	\$17.50



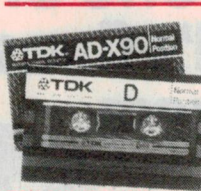
### VDK1 VIDEO DUBBING KIT

For European and Japanese machines.

Contains:  
Audio/Video: 6 pin DIN plug to 6 pin DIN plug 1.5 metres.  
Audio/Video: 6 pin DIN socket to (a) Video: RCA plug (b) Audio: 5 pin DIN plug. (Both 16cm in length)  
Video: 1 each plug adaptor (PA21) RCA socket to PL259 plug. (PA23) RCA socket to BNC plug.  
Audio: 5 pin DIN socket to 2 RCA plugs 16cm length 2 plug adaptors (PA60) RCA socket to 3.5mm phone plug.  
Cat. **\$16.95**



## AUDIO PRODUCTS!



### TDK AUDIO TAPE BARGAINS

Description	Cat. No.	1-9	10+
DC46 TDK A11305		2.75	2.10
DC60 TDK A11307		2.85	2.25
DC90 TDK A11309		3.50	5.50
DC120 TDK A11311		5.50	4.25
AD60 TDK A11315		3.75	2.95
AD90 TDK A11317		4.75	3.50
AD120 TDK A11319		6.95	5.50
ADX90 TDK A11320		4.95	3.50
ADX90 TDK A11322		5.95	4.50
SA60 TDK A11325		5.35	3.95
SA90 TDK A11327		5.95	4.50
SAX60 TDK A11329		5.25	3.95
MAC60 TDK A11335		6.95	5.95
SAX90 TDK A11332		10.95	9.35
MAC90 TDK A11337		11.50	8.75
MAR60 TDK A11340		13.50	10.95
MAR90 TDK A11342		17.20	15.35



### SUPER HORN

- Wide dispersion tweeter, handles up to 100W.
- Sensitivity: 105dB/0.5m
- Frequency Response: 3kHz-30kHz
- Impedance: 8 OHMS
- Size: 145x54mm

Cat. C12102 **\$12.95**



### ELECTRONIC CASSETTE DEMAGNETISER

Save \$2. Rec. retail \$19.95  
Cat. A1006 **NOW \$17.95**



### TDK LINE FILTERS

240 V 3A Cat. **\$12.50**



### P.A. SPEAKERS

Low dual cone, wide range. 200mm (Bin.). Ideal for public address, background music, etc. Tremendous Value at these prices!  
Cat. C12000 **1-9 \$5.95 10+ \$4.95**

## JOYSTICKS!



### CENTRE RETURN JOYSTICK

Features 2x150K pots, long shaft 40mm with 25mm control ball. Bonus adjustable offset feature on pots.  
Cat. X15637 **1-9 \$9.95 10+ \$8.95**



### ARCADE FIRE BUTTONS

With micro switches. Cat. **\$9.95**

## COMPUTER ACCESSORIES!



### REPLACEMENT KEYBOARDS

- For Apple
- 42 single key BASIC command
- One chip custom design encoder
- Made by ALPS, life time, 10 million operations
- Dimension: L340xW110xH42mm

Cat. KC2002 **\$79.50**



### IBM\* COMPATIBLE COMPUTER

128K RAM, colour graphics, 2 serial and 1 parallel ports, 2 disk drives, 3 months warranty  
**an incredible \$1,950**

\*IBM is a registered trademark.



### RITRON (ZETA) DATASETTE

For data loading and saving, this Micron Datasette suits most home computers and features tape counter, monitor function for audio verification and slide volume control for output level.  
Cat. C14900 **\$24.95**



### RITRON 2

Stylish swivel base monitor, available in amber or green.  
**1-9 \$215 10+ \$205**

Green Cat. X14500

Amber Cat. X14500

**\$219 10+ \$205**

### NOW IN STOCK!



### RITRON MULTI PURPOSE MODEM

Our new RITRON Multi Purpose Modem has arrived and has all the standards you require. Just check the Ritron's features:

- CCITT V21 300 Baud Full duplex
- CCITT V23 1200/75
- Bell 103 300 Full duplex
- Bell 202 1200 Half duplex
- Auto answer, auto disconnect.

Telecom Approval No. C84/37/1134 **\$379**



### RITMAN INFO RUNNER

An exciting new printer from the experts "Ritman". This compact stylish printer performs like printers twice its price and size. 120 C.P.S., dot resolution graphics, tractor/friction feed, 10" paper. **\$459**



### IBM COMPATIBLE DISK DRIVE

(NEW MITSUBISHI 4851)

Slimline 5 1/4" disk drive. Double sided, double density 500K unformatted, 40 track/side. Steel band drive system.

Cat. C11901 **\$199**

Case & Power Supply to suit

Cat. X11011 **\$99**



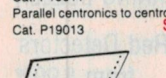
### TELECOMMUNICATION PLUG TO 2 SOCKETS.

Ideal for modem connections. Cat. Y16014 **\$12.95**



### READY MADE CABLES

Serial to Serial Cat. P19011 **\$18.95**  
Parallel centronics to centronics Cat. P19013 **\$23.95**



### COMPUTER PAPER

Top quality at a very affordable price! Blank 11 x 9 1/2", 2,000 sheet, quality 80 gsm bond paper.

Cat. C21001 **\$29.50**

## CHEAP DISKS!



### DISKS GALORE!!

All prices for boxes of 10. Single disks 10% extra.

### SPECIALS!

MD525-01 S/D D Cat. C12501 **\$29.50**  
MD550-01 D/S D Cat. C12504 **\$39.50**

### Head Cleaners

C12551 5" Head Cleaner **\$10.50**  
C12851 8" Head Cleaner **\$11.50**

### VALUELIFE

C12421 S/D D/D **\$22.95**  
C12425 D/S D/D **\$29.95**

### 8" Verbatim

C12800 FD32-1000 S/S/D	\$39.50
C12801 FD32-8000 S/S/D	\$49.50
C12802 FD32-9000 S/S/D	\$49.50
C12803 FD34-1000 S/S/D	\$49.50
C12804 FD34-8000 S/S/D	\$55.50
C12805 FD10-4008 D/S/D	\$59.50
C12806 FD10-4015 D/S/D	\$64.50
C12807 FD10-4026 D/S/D	\$64.50
C12808 FF32-2000 S/D/D	\$69.00
C12809 FF34-2000 S/D/D	\$69.00
C12810 DD32-4000 D/S/D	\$69.00
C12811 DD34-4001 D/S/D	\$52.50
C12812 DD34-4008 D/S/D	\$52.50
C12813 DD34-4015 D/S/D	\$54.50
C12814 DD34-4026 D/S/D	\$54.50

### 5 1/4" Verbatim Disks

5 year Datafile guarantee

MD525-01 (S/S D)	C12501	\$29.50
MD525-10 (S/S D/D 10 Sect. 40 Track)	C12502	\$39.50
MD525-16 (S/S D/D 16 Sect 40 Track)	C12503	\$39.50
MD550-01 (D/S D)	C12504	\$49.50
MD550-01 (D/S D/D 10 Sect 40 Track)	C12505	\$49.50
MD550-16 (D/S D/D 16 Sect 40 Track)	C12506	\$49.50
MD57-01 (S/S D/D Soft Sect 80 Track)	C12507	\$59.50
MD57-10 (S/S D/D 10 Sect 80 Track)	C12508	\$59.50
MD57-16 (S/S D/D 16 Sect 80 Track)	C12509	\$59.50
MD557-01 (D/S D/D Soft Sect 80 Track)	C12510	\$59.50
MD557-16 (D/S D/D 16 Sect 80 Track)	C12511	\$59.50



### XIDEX DISKS

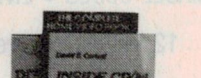
1-9 **\$34.50** 10+ **\$29.50**

Box of 10 S.S. D.D. Cat. C12401

Box of 10 D.S. D.D. Cat. C12410 **\$39.50**

**\$37.50**

## PUBLICATIONS!



### Inside CP/M

by David E. Cortesi **\$41.95**

### The Complete Home Video Book Vol. 2

**\$25.95**

The Robotics Primer **\$17.95**  
by Robert A. Ullrich



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NORTHCOE, 3070

VICTORIA, AUSTRALIA

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TELEX: AA 38897

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MELBOURNE, 3000

VICTORIA, AUSTRALIA

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correspondence:

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NORTHCOE 3070

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**(03) 481 1436**

### POSTAGE RATES

\$1-\$9.99 ..... \$2.00

\$10-\$24.99 ..... \$3.00

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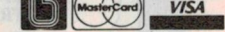
\$50-\$99.99 ..... \$5.00

\$100-\$199 ..... \$7.50

\$200-\$499 ..... \$10.00

\$500 plus ..... \$12.50

This is for basic postage only. Comet Road freight, bulky and fragile items will be charged at different rates.



## WHO'S NEW AT ROD IRVING ELECTRONICS?

We would like to introduce you to the new General Manager of Rod Irving Electronics's.

General Manager, Howard Rider.

Howard has had extensive electronics experience, over 40 years in fact. He has worked as a radio and electrical contractor, a college lecturer with the Department of Education (including 10 years overseas) and is a prominent figure in amateur radio and in particular amateur television.

Howard recently retired from lecturing to take up the position of General Manager for Rod Irving Electronics.

"Please feel free to drop in anytime you're in the area and make yourself known to me personally."

-Howard Rider

Errors and omissions excepted

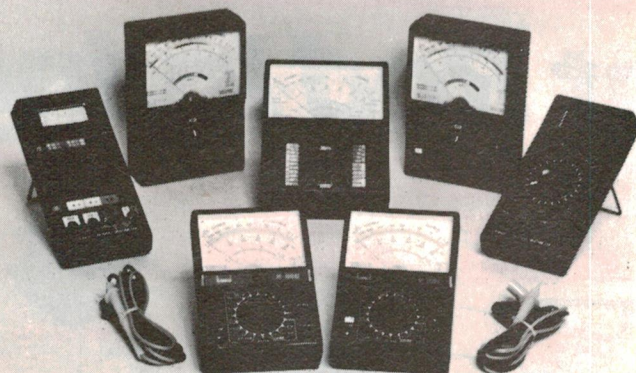
# GRUV-GLIDE

## THE 15° SOLUTION TO RECORD WEAR

GRUV-GLIDES claims of complete record care and protection are now accepted by most discerning record users. Gruv-Glide replaces all other record cleaning methods in one simple application. Gruv-Glide will actually improve the sound from your records (old and new). You can make the test by taking one of your own records to your local Gruv-Glide dealer. Gruv-Glide will also remove old record cleaners that clog your stylus, and at around 15¢ a record is a most economical treatment.

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Now, when you need a multimeter  
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instruments have everything  
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HC 129

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### SUPPLIERS OF QUALITY ALARM EQUIPMENT



4 Sector DIGITAL  
Alarm Control  
only \$156.<sup>00</sup>

#### Features:

- N/O — N/C INPUTS • ADJUSTABLE ENTRY/EXIT TIMES
- PROGRAMMABLE CODES • ENTRY WARNING BUZZER



12 Meter Passive Intra-Red Detectors  
from \$90.<sup>00</sup>

We stock a complete range of alarm  
equipment at Discount Prices.

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## Build one of the world's finest 2-way speakers. \$714.

For the unadulterated  
pleasure of pure, detailed  
and accurate sound, it is  
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Dynaudio drivers.

Dynaudio drivers use hexagonal voice  
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# ALL ELECTRONIC COMPONENTS

118-122 LONSDALE STREET, MELBOURNE, VIC. 3000. Australia  
Telephone: 662 3506

## ETI 182-DIGITAL LUXMETER

This instrument is a portable, battery operated device for measuring illumination. It covers light levels from below 1 LUX up to 20K LUX in two ranges and includes low battery indication.

**\$88.28** inc tax  
includes all parts and genuine INTERSIL

## ETI 699-300 BAUD DIRECT CONNECT MODEM

- Use your telephone to access a floppy disc for the price of a local call
- Download hundreds of free programs
- Use "Electronic Mail"
- A modem will make your computer a remote terminal on some of the most exciting systems around. Join the Big Boys for only

**\$140.42** inc tax  
• Less F/P & Handset

## ETI 1405 STEREO ENHANCER

This project creates an 'enhanced stereo effect' with a small unit which attaches to your amp.—EASY! INCLUDES SUPERIOR COMPONENTS—NOT HOBBY GRADE! SILK SCREENED ALUMINIUM FRONT PANEL, HOORWOOD CASE, FERGUSON TRANSFORMER, PHILIPS RESISTORS, ETC. ETC. ETC.

**\$141.70** inc tax

Don't risk damaging your amp with an inferior unit.



**AT LAST ETI 279 COMPLETE KITSET**  
**\$30.16** inc tax

## ETI 683 MINDMASTER-HUMAN COMPUTER LINK

There are times when computer buffs require a different type of control to that provided by simple game controllers or joysticks. This unit provides control of a computer by using the human mind. Both Main unit and Receive unit, including panels, cases, and all components for only

**\$74.07** inc tax

Importers ◊ General Sales ◊ Radio Equipment ◊ Microwave Equipment ◊ Radar Equipment ◊ Pulse Techniques ◊ Industrial Electronics ◊ Instrumentation

E.O.E.

# 25 cm flat colour TV

Matsushita Electric of Japan has developed a new 'colour flat panel' which it has incorporated in a prototype of a flat colour television featuring a 25 cm diagonal screen and a depth of only 9.9 cm.

The new colour flat panel has a square, completely flat screen that reproduces distortion-free images throughout the entire display area. These features make the screen suitable for text, videotex and high definition TV.

The colour flat panel was developed using Matsushita's Matrix Drive and Deflection System. This system produces the high colour reproducibility, high resolution and brightness of existing colour picture tubes. The flat colour TV prototype provides a resolution of 270 TV lines, a contrast ratio of more than 50, and a brightness of over 70 fL.

The Matrix Drive and Deflection System produces 3000 controlled beams by forming a matrix of 15 filament cathodes and 200 electron beam control electrodes which cross cathodes at right angles. Each beam is horizontally deflected in six steps



(two sets of RGB) and vertically deflected in 32 steps (including the interlace) to form images consisting of 192,000 elements

on the display panel. A complete picture is formed through the line-at-a-time method.

The Matsushita system lacks

the shadow mask found in conventional colour picture tubes and this necessitates a fine electron beam of the same width as a phosphor stripe. Separation of the horizontal and vertical lens systems to provide individual control of their focusings has resulted in improved resolution and colour reproducibility.

The development of a cementing technology which evenly and alternately adheres 0.1 mm grid electrodes with insulating plates was of special importance in gaining uniform display.

Signal processing and driving are performed digitally. Picture brightness is controlled by varying the pulse width which drives electron beams, thereby generating 64 steps in grey scale.

Colour reproduction is achieved by digitizing the picture signal and alternately driving the red, green and blue circuits.

A release date for Australia

## Top of range CD player

Philips' CD304 Compact Disc Player uses digital technology throughout, including the circuits for the drive motor control and audio signal filtering.

Superior error correction is achieved because the signal is oversampled four times in the digital filter — double or quadruple the rate in competitive systems. Filtering is carried out in such a way that frequencies over 20 kHz are attenuated by 50 dB after digital to analogue conversion. Despite the sharp cut off, the system is phase linear.

The filter is followed by a noise shaper to achieve a total system signal-to-noise ratio of about 97 dB.



## Colouring b&w movies

has not yet been announced.

An established semiconductor manufacturer and a Los Angeles-based start-up organization have teamed together to form a new company, Color Systems Technology, which specializes in converting black-and-white film to colour videotape for showing on television. The conversion is made using a specially built computer based on Intel computer boards.

Color Systems has already converted footage used in "King", an NBC docu-drama about Martin Luther King Jr, and "Ike", an ABC docu-drama about Dwight D. Eisenhower. The company has a contract with MGM/United Artists and Warner Amex to colour-convert such classic films as "Dr Jekyll and Mr Hyde" and "Camille", as well as a contract with Universal/NBC to bring colour to the original Alfred Hitchcock introductions seen in his 1955-65 television series for a new TV pilot, "Alfred Hitchcock Presents".

The patented colour spectrography process was invented by Color Systems' chairman, Ralph Weinger. Because the technology was new and no existing system met the flexibility and performance requirements, Color Systems chose to build a custom computer system and workstations using Intel's family of Multibus board-level micro-computer products.

Color Systems engineers did their original colour conversions using a prototype built in-house. Once they knew their technology worked, they began to investigate other alternatives that would make the process economical.

Color Systems built a portion of the computer itself. "The actual handling of the video image requires fast, elaborate processing, and we put that together ourselves using parallel and pipeline processing," said Weinger. But the company is hoping that Intel might be interested in developing a chip in the future that would offer these

same capabilities.

The Intel/Color Systems system consists of one workstation and several independent processors to carry out the computing tasks required for the colour process. A single operator controls the operations of the separate processors.

The first step in the patented colour spectrography process is to transfer the black-and-white original material to 1-inch videotape. Then a colourist, sitting at a workstation, selects a key frame in a scene and assigns colour values to the image. Next, in a process similar to key frame animation in computer graphics, the computer automatically continues to colour the scene to completion. The final colour-converted product is then recorded on broadcast-quality 1-inch videotape. The original film is not altered in any way.

The colour values assigned to scenes can also be stored in the system's memory for later recall. This feature is especially useful for black-and-white television series where the same sets and actors were used in each segment.

The system may also be useful for contemporary videotape and film production. For example, if developed footage appears too light or too dark, or the colour of an actor's suit clashes or blends with the background, colourists can correct the problems and eliminate any need for an expensive reshoot.

Color Systems plans to have three systems running around the clock, which means it will be able to colour-convert an average of one hour of program each day.

The demand for the colour conversion process seems limitless. Copyrights on thousands of Hollywood black-and-white classics have expired, and studios are likely to be granted new copyrights for colour versions of the same films. As well, there are thousands of hours of black-and-white television tape in studio vaults.

### TV Walkman

A personal stereo Walkman FM radio with a wide tuning range that can pick up TV sound transmissions is available from Zap Electronics for \$29.50 rrp. It's called the "Teleboy" and is particularly useful for those who are hard of hearing or who want to watch TV without disturbing anyone else.

### Power cassette

BASF has formulated a ferric oxide tape with high density coating to cater for the demands of rock music. Called the LH Maximal, it has the advantage over conventional iron oxide tapes of improved dynamic range, especially in the high end. The cassette comes in a high precision housing.

### Avant-garde TV

Normande's Spectra Stereo 8107 TV has a 27-inch precision colour tube and a digital chassis featuring low current consumption and reliability. It includes a Euroconnector for audio-visual media facilities, two 2-way loudspeakers, and individual picture and sound settings for up to 30 programmes.

### Computer-controller FM/AM tuner

JVC's T-X900(L) B tuner integrates microprocessor technology with traditional audio technology so that when a station is tuned in, the computer takes over to optimize tuning parameters. Ten FM and ten AM stations can be memorized for recall and when a station is entered into the computer memory, tuning parameters are memorized also.

### Graphite loudspeakers

The problems of trying to create sonic purity and richness of sound in a less than perfect environment, such as cars, have been met with a new line of loudspeakers, the Graphite Series from JBL. The frame and basket assemblies are made of an amalgam including graphite, which makes them non-resonant, non-ferrous and non-conducting.

### Audio-video cabinet

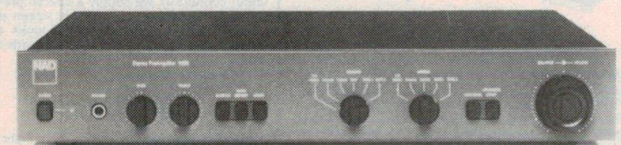
Systemline Furniture's new utility cabinet for video and audio equipment features timber frame glass doors, adjustable shelves and hidden castors. The 800 mm wide TV section will accommodate most television receivers.

### Mono Teletext receivers

Philips has extended its range of Teletext TV receivers with three new mono set models. The 54 cm CS.235 has standard Teletext while the 62 cm CR.635 and the 54 cm CR.235 will accommodate later fitting of a Teletext decoder.

### Stereo preamplifier

NAD claims freedom from distortion, even in high-level peaks 30 dB above the average signal level, with its model 1155 stereo preamplifier. The all-discrete phono circuit has a dynamic range over 100 dB. The preamplifier also features parallel input selectors, one for listening and the other for recording. Rrp is \$549.



# JAYCAR KITS - LATEST RELEASES

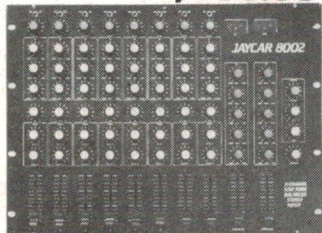
## EA KITS

### 8 CHANNEL MIXER Model 8002

Jaycar engineers have produced a real winner with the 8002 stereo mixer. The front panel measures 19" wide x 14" high (8 rack units). This enables the 8002 to be mounted into PA racks if necessary. It has many features including: • Balanced (600 ohm) mic inputs/line inputs • Input attenuators • Bass, mid and treble equalisation on each input • "Effects" capability • Foldback on all 8 inputs • Stereo pan on all 8 inputs • 5534A OP amps for low noise and very low distortion PLUS many other features and specs to be found in the 1985 catalogue on page 4/5.

Ref: EA April/May 1983.  
Cat. KJ-6504

**ONLY \$535.00**



### IN-CIRCUIT TRANSISTOR TESTER

Ref: EA September 1983

Have you ever unsoldered a suspect transistor only to find that it checks O.K.? Troubleshooting exercises are often hindered by this type of false alarm. You can avoid these hassles with the 'In Circuit' transistor, SCR and diode tester.

The kit does just that, tests devices WITHOUT the need to unsolder from the circuit! VERY handy! The Jaycar kit includes a Jiffy box and Scotchcal panel showing the truth table for device checking.  
Cat. KA-1119

**ONLY \$15.00**



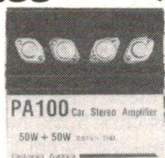
### Car Booster Amp

Ref: EA August 1985.

This project enables you to have 2 x 50 watts RMS of power for your car sound system. In order to do this, a special high voltage power supply forms part of the system. Absolutely stunning value for money. Around half the price of inferior commercial units.

The Jaycar kit is, as usual, absolutely complete.  
Cat. KA-1600

**ONLY \$179.00**



### 40 WATT DC INVERTER

Ref: EA August 1985

An upgrade of a previous design featuring a smart new ABS case.  
Cat. KA-1598



**\$79.95**

### Motorcycle Intercom

Ref: EA Feb 1984

What a great kit! This full duplex unit enables you to talk to your pillion passenger whilst riding with your helmets on! Powered by the bikes battery - you can both talk at the same time if you wish as there are no switches to activate. The Jaycar kit includes the special headphone inserts and all parts.  
Cat. KA-1533

**ONLY \$39.95**



### "RAILMASTER" Pulse-Power Train Controller

Ref: EA September 1984

This is a state-of-the-art train controller offering tremendous features.

- ★ Variable simulated inertia
- ★ Full short circuit protection including both audible and visual indicators
- ★ Power and track monitor indicators
- ★ Adequate power for double and triple heading locos
- ★ Fixed 12V DC and 15V AC power for lighting and accessories
- ★ Optional walk-around throttle

The Jaycar kit includes realistic Scotchcal front panel and the special console case only available from us. The large paddle switches have been specially imported just for this kit. We believe that you will be delighted with this unit.  
Cat. KA-1560

**\$79.95**  
**Optional Walk Around Controller** Cat. KA-1559  
**ONLY \$9.95**

### Diesel Sound Simulator

Ref: EA November 1984

This project mounts inside a model train (i.e. goods wagon) and produces a noise similar to a diesel locomotive. The 'speed' varies according to the throttle action for added realism. All listed parts provided.  
Cat. KA-1561

**\$19.95**  
**Steam Sound Simulator**

Ref: EA December 1984

Build this realistic steam sound simulator for your model train layout. It features an infra-red optical switch to synchronise the "chuffs" to the wheel rotation. Like the KA-1561, it picks up the power from the railway tracks. All specified components supplied including 32 ohm headphone type transducer.  
Cat. KA-1562

**\$15.95**  
**FUNCTION GENERATOR with digital readout**

Ref: EA April 1982

This attractively housed (matches the KA-1390 DFM) unit produces sine, triangle and square waves over a frequency range from below 20Hz to over 160kHz with low distortion and good envelope stability. It has an inbuilt 4-digit frequency counter for ease and accuracy of the frequency setting.  
Cat. KA-1428

**\$94.00**

For all specs see the 1985 Jaycar catalogue



### 50/500 Digital Frequency Counter

Ref: EA Dec 1981/Feb 1982

This is a high performance unit that is also easy to build! The new design uses just 5 ICs, measures period and frequencies up to 500MHz (with prescaler). It features a bright 7 digit display and outperforms ready built units costing 2-3 times more!

We believe that the Jaycar version of this kit is by far the best. Not only do we supply 2 x GOLD plated BNC input connectors we supply a special pre-punched heavy plastic front panel that is screen printed in epoxy ink. The assembled unit looks a million dollars! Watch out for kits that only provide the cheap front panels!

The standard kit will work up to 50MHz  
Cat. KA-1390

**\$119.00**

A 500MHz prescaler kit (which fits straight onto the main circuit board) is available.  
Cat. KA-1392

**\$29.50**

For all specs see Jaycar's 1985 catalogue

## EA KITS

### Digital Bench Type Capacitance Meter

Ref: EA August 1985

- ★ Easy to assemble
- ★ 4 digit LED readout
- ★ Measures from 1pF to 99.9uF
- ★ 3 ranges
- ★ Bench type mains powered

Cat. KA-1595

**NEW**  
**ONLY \$79.95**

### 8 SECTOR BURGLAR ALARM

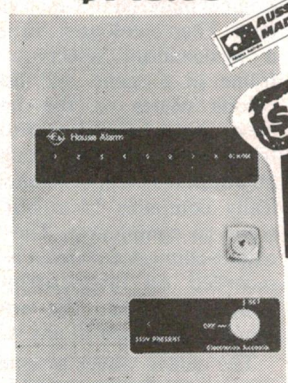
Ref: EA Jan/Feb 1985

Why buy a commercially made up unit for more when you can buy this kit and SAVE money! A unique feature of this kit is the fact that you can wire N/O and N/C alarm sensors ON THE SAME LINE.

- ★ 8 SECTORS
- ★ 2 delayed entry sectors
- ★ Steel box
- ★ Includes battery and siren driver in the price
- ★ Variable exit and entry delays

Cat. KA-1580

**\$149.00**



### BUSKER AMPLIFIER

Ref: EA Feb 1985

Fantastic, portable amplifier kit for low-level PA, Buskers or for practice.

- ★ Battery or mains operation
- ★ Full control - bass, treble and volume
- ★ 17 WATTS RMS output
- ★ Gel battery automatically recharged when mains used.

★ INTRODUCTORY PRICE ★

**ONLY \$125.00**

All electronics including Gel battery, 8" speaker, metal chassis etc.

Cat. KA-1592

**PRE-CUT WOODEN CABINET** to suit  
Cat. KA-1593

**ONLY \$30.00**  
**BUY BOTH AND PAY ONLY \$149.00**  
**A FURTHER SAVING**

### ULTRASONIC BURGLAR ALARM

- Easy to install
- Connect with magnetic switch, Infra Red detector, etc.
- N/O and N/C circuit breakdown indicator. Fully assembled — Don't pay up to \$99. JAYCAR PRICE

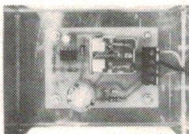
Cat: LA5140

**\$69.00**

### Ignition Killer

Ref: EA Feb 1984

This little project is cheap, easy to fit and is effective. It basically is a timer circuit that disables your ignition system a few seconds after it is activated. A would-be thief starts the car, it goes a few metres and stops. He immediately cranks the engine and it fires but it stops again moments later. This could continue indefinitely. Frustrated, the thief looks for easier "game" elsewhere. The Jaycar kit contains specified original components, instructions and two BONUS alarm stickers.  
Cat. KA-1535



**ONLY \$14.95**

## EA KITS

### PLAYMASTER SERIES II MOSFET AMP KIT

Ref: EA Jan/Feb/March 1985

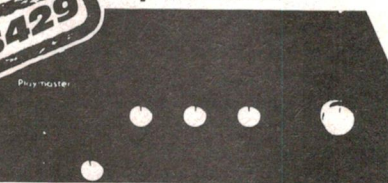
"... s stereo amplifier that will equal or better just about any integrated commercial amplifier, regardless of price". Leo Simpson, Editor of EA, February 1985.

#### MAIN FEATURES

- Switchable phono input for MM and MC cartridges
- Electronic signal switching
- Full facilities for dubbing between two cassette decks
- Monitor loop for either of two cassette decks or a signal processor
- Click action pushbutton switches for selection of sources, dubbing and tape monitor with LED status indicators.
- Centre detents on bass, treble and balance controls, multiple detents on volume control
- Heavy duty heatsinks
- Power transformer for low hum and noise
- Easy to build - all parts except power supply mount directly on the two printed circuit boards; wiring has been kept to an absolute minimum
- 100 watts RMS per channel into 8 ohm load
- Less than 0.01% total harmonic distortion

Cat. KA-1500

**ONLY \$429.00**



### 5(6.5)MHz OSCILLOSCOPE KIT

Ref: EA October 1984

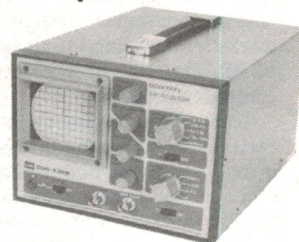
Over the years many people have asked, "Do you have a CRO kit?" Our answer - up until now - has been that built and tested units were no dearer than kits, if you could get a kit at all.

The Jaycar KJ-7050 Cathode Ray Oscilloscope kit has a guaranteed 5MHz bandwidth but should go to around 6.5MHz. It also features 75mm (3") CRT Blue Phosphor with accurate graticule, separate vertical and horizontal BNC type input sockets etc. Remember, a 5MHz 'scope is usually adequate to troubleshoot most microprocessor and other digital circuitry as well!

This is a wonderful opportunity to learn electronics AND end up with a valuable piece of test equipment as well.

The Jaycar KJ-7050 kit is absolutely complete. The chassis is pre-punched and every component including nuts and bolts are provided, along with instructions.  
Cat. KJ-7050

**ONLY \$269.00**



### Dual Tracking ±22V Power Supply

Ref: EA March 1982

This versatile dual polarity (dual tracking) power supply kit can provide up to ±22 volts at up to 2 amps. In addition the supply features a fixed +5V at 0.9 amp output. The supply is completely protected against short circuits, overloads and thermal runaway. Kit comes complete with case, meter and front panel.  
Cat. KA-1410

**ONLY \$99.50**

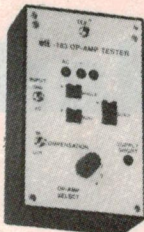


# & GREAT SPECIALS! ★★★★★★

## ETI KITS

### OP-Amp Tester

Ref: ETI April 1985. Test OP-Amps with 741 - type pinouts (e.g. TL071, TL074, 5534 etc), with this nifty tester. Checks single, dual and quad packages! Cat. KE-4693



**ONLY \$29.95**

### Electronic Jumper Leads - ETI 341

Ref: ETI August 1985. This project enables you to charge up a car battery via the cigarette lighter plugs in each car. A small inverter boosts the battery voltage from car No.1 to charge the flat battery in car No.2 via its cigarette lighter socket. It's amazing how quickly you can put enough charge in a flat battery to start the car! Complete set of parts including 2 x cigarette lighter plugs. Cat. KE-4703



**\$39.95 NEW**

### ETI 1527 Economy House/Car Alarm Module

Ref: ETI May 1985. This low cost full feature module can form the basis of a sophisticated anti-theft system! Cat. KE-4698

**\$24.95**

### ETI 699 Modem Kit

Ref: ETI May 1985. This brilliant new design is a price breakthrough. Never has a modem with such SOPHISTICATED FEATURES been offered at such an incredibly low price. Now you can have no excuse to gain the tremendous benefits that a modem will offer viz:

- ★ Access to huge data banks
- ★ Networking
- ★ Telecommunications
- ★ Electronic shopping
- ★ Software exchange
- ★ And much more

This ETI kit is a full modem with facilities similar to units costing hundreds of dollars more. It even includes a Telecom approved push button telephone! Now is your chance to use your electronic skills in your new hobby and save a fortune over ready built. You can obtain this modem kit (which includes a telephone for use humans) for the incredibly low introductory price of only \$139. That's right! \$139, inc. case, down to the last nut and bolt. But hurry! Stocks of the critical modem chip are very low and will severely limit kit supply. Cat. KE-4695

**ONLY \$139.00**

### ETI 698 Microbee Dialler

ETI July 1985. Complete set of parts. Cat. KE-4696

**ONLY \$19.95**

## AEM KITS

### The Listening Post

Ref: AEM July 1985. This device attaches between audio output of a short wave receiver and the input port of a computer. It allows decoding and printing of Morse Code, Radioteletype (RTTY), AND radio facsimile (FAX) pictures! You can, for example, watch weather maps from the Met and dump them on to your printer! Specific software for the Microbee is in the first article. Programs for other popular computers will be printed in later issues of AEM. Complete set of specified components (inc. IDC plug). Cat. KM-3015

**ONLY \$29.50**



### AEM 6500 - 60/120 WATT UTILITY MOSFET AMP MODULES

Ref: AEM July 1985. This is a low cost high performance design using proven MOSFET technology. A single pair of (2SJ49/2SK134) Mosfets will deliver up to 60 watts output. Another pair may be added for 120 watt performance. The module has been designed to fit into a large variety of commonly stocked instrument cases and rack boxes. It features VERY LOW distortion and impeccable transient performance. It is unconditionally stable and virtually blow-up proof. It can be powered from common transformer/rectifier/-capacitor combinations. A Winner! As usual, the Jaycar kit reflects a quality approach. All specified components for each version are included.

**60 WATT MODULE Cat. KM-3010 \$49.50**  
**120 WATT MODULE Cat. KM-3012 \$65.00**



### AEM 9500 Beat Triggered Strobe

Ref: AEM July 1985. This project provides a very bright stroboscopic effect for parties, discos, etc., but with an ADDITIONAL FEATURE! This strobe will actually flash in synchronisation with the music! The Jaycar kit includes case, photographic reflector, flash tube etc. Cat. KM-3018



**ONLY \$59.00**

## SPEAKER SENSATION! European Style 2-way Speaker Kit Sensational NEW design by Dave Tillbrook

Ever thought of buying a pair of those \$1000 - odd British two-way speaker systems that are so popular and they ARE expensive! Dave Tillbrook has come to the rescue with a high power two-way system with similar (if not superior) performance specs. at around HALF the price of ready built!

The system uses Danish-made 'Vifa' brand speaker drivers. 'Vifa' actually manufactures the speaker components for many well known system manufacturers (including British) but we are not allowed to reveal which ones.

The 8" woofer cone is made of a special material called Polycone. It has high internal damping and is superior to other plastic diaphragm materials such as bextrene or polypropylene.

Full specs appear below. The tweeter is a soft dome type with the voice coil air gap filled with a magnetic fluid. This state-of-the-art technique reduces the Q value at the resonant frequency and also provides cooling for the voice coil. (Specs appear below).

The crossover network is the main secret to the high performance of the system, however, it has been especially designed by Dave Tillbrook to maximise the performance of each speaker component. It has a very high roll-off characteristic to minimise colouration at the crossover frequency.

The cabinet, of course, is a bass reflex design, calculated using the Thiele/Small parameters of the woofer. Response of the system extends from 30Hz to around 18kHz. System power is conservatively rated at 100 watts RMS.

Jaycar is stocking the speaker and crossover kit components. Depending on demand we may produce a cabinet kit. Our bulk purchasing power enables us to pass the components to you at the lowest possible cost.

### SPEAKERS:

Tweeter DZSTG 8 ohm Cat. CT-2020 **\$45.00 ea - \$90.00 pair**

Woofer PZ1WO 8 ohm Cat. CW-2132 **\$122.00 ea - \$244.00 pair**

Crossover Network (Kit) Cat. CX-2630 **\$39.95 ea - \$79.90 pair**

**Total \$413.90 for stereo SPECIAL INTRODUCTORY OFFER**

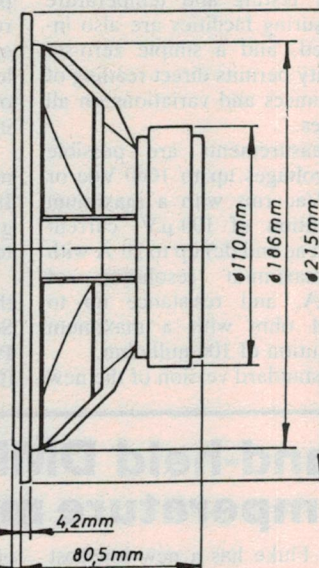
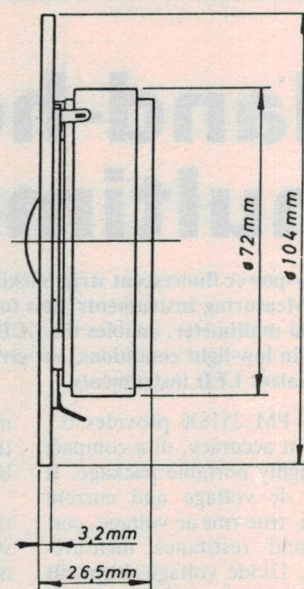
The low value of the Australian dollar may mean that the prices of these components will go up. As a goodwill gesture, we will sell the speaker/crossover set (for stereo) for only:

**\$399.00!!!**

This offer is only valid for August 1985. We estimate that you will be able to build the cabinets for around \$50 - \$90 (depending on finish). This means that you can end up with a superior 100 watt speaker system for under \$500!!!

### UNBELIEVABLE Technical Data - Woofer

Nominal Impedance	8 ohms
Frequency Range	26 - 4000Hz
Free Air Resonance	33Hz
Operating Power	2.5W
Sensitivity (1W @ 1m)	92dB
Nominal Power	60 watts
Voice Coil Diameter	40mm
Voice Coil Height	12mm
Air Gap Height	6mm
Voice Coil Resistance	5.8 ohms
Effective Diaphragm Area	222cm <sup>2</sup>
Moving Mass	20 grams
Thiele/Small Parameters	
Qm : 2.4	
Qe : 0.41	
Qt : 0.35	
Vas : 80 l	
Weight	1.65kg



### Technical Data - Tweeter

Nominal Impedance	6 ohms
Frequency Range	2 - 24kHz
Free Air Resonance	1500Hz
Operating Power	3.2 watts
Sensitivity (1W @ 1m)	90dB
Nominal Power	90 watts
Voice Coil Diameter	25mm
Voice Coil Height	1.6mm
Air Gap Height	2.0mm
Voice Coil Resistance	4.7 ohms
Effective Diaphragm Area	7cm <sup>2</sup>
Moving Mass	0.3 grams
Weight	0.53kg

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# Hand-held digital multimeter works in dark

A low-power fluorescent strip backlighting option, in Philips Test and Measuring Instruments' new four-digit PM 2518X hand-held digital multimeter, enables the LCD (liquid crystal display) to be read in low-light conditions, yet gives 10 times the battery life of equivalent LED instruments.

The PM 2518X provides 0.1 per cent accuracy, in a compact and highly portable package. It offers dc voltage and current ranges, true rms ac voltage, current and resistance measurements. Diode voltage drop, dB measurements, audible continuity testing and temperature measuring facilities are also included, and a simple zero-set facility permits direct reading of tolerances and variations on all ranges.

Measurements are possible for voltages up to 1000 Vdc or 600 Vac rms with a maximum resolution of 100  $\mu$ V, current (both ac and dc) up to 20 A with a maximum resolution of 10  $\mu$ A, and resistance up to 100M ohm with a maximum resolution of 100 milliohm.

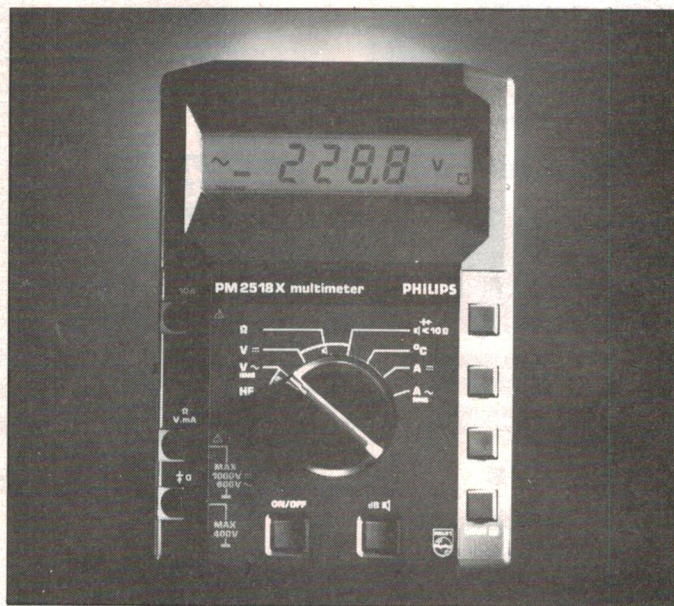
A standard version of the new

multimeter is also available for those who do not require the backlit display.

Function selection on the multimeter is by a single rotary switch. Full autoranging, with manual override, ensures a fast and stable display of unknown parameters. Only two inputs are required for all measurements except high current. Full overload protection is provided, with overload or improper use being indicated on the display.

A simple one-board design, making extensive use of Intel/Philips I<sup>2</sup>C (inter-integrated circuit) bus connection technology, aids reliability.

For more information about the PM 2518X contact **Philips Scientific and Industrial, 25-27 Paul St, North Ryde, NSW 2113. (02)888-0403.**



## Hand-held DMM temperature measurement

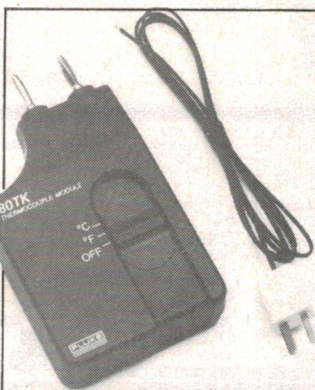
John Fluke has a new low-cost thermocouple converter, the 80TK, which plugs into any bench or hand-held DMM (standard banana plug input) to give temperature measurement capability.

Powered by a standard 9 V battery (1600 hr life), the 80TK converts the microvolt output from a 'K' type thermocouple into a 1 mV per degree signal. The compact package contains both cold junction reference and scaling, and works with any 3½ digit multimeter having a 10 megohm or greater input impedance.

The input connection to the 80TK is through a 'mini' thermocouple connector which is attached to all available probes. This arrangement allows the measurement of any range

of temperature with one base unit by simply plugging in a different probe. Three Fluke probes are currently available.

For further information contact **Elmeasco Instruments Pty Ltd, 15 McDonald St, Mortlake, NSW 2137. (02)736-2888.**



## Small pc board drill

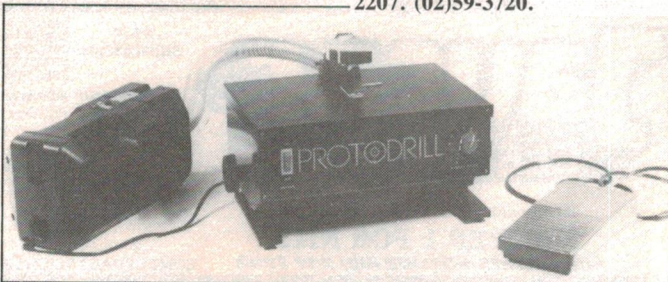
A tabletop drill for short-run printed circuit board production and prototyping has been released by **Circuit Components.**

The new drill, known as the Amden Protodrill, is designed to help reduce both the cost and lead times of subcontracting short-run pcb production and prototype services.

The Protodrill is claimed to be easy and clean to operate. Featuring an adjustable, tilting

worktable for the most comfortable working position, it is activated by a footswitch, leaving the operator's hands free to control the positioning of the printed circuit board. A special X4 magnifier allows easy positioning of the printed circuit board over the Protodrill's drill point.

For brochures and additional information contact **Circuit Components (A'Asia) Pty Ltd, 383 Forest Rd, Bexley, NSW 2207. (02)59-3720.**



## In-circuit emulator

Alfatron has been appointed sole Australian distributor for the Kokusai range of in-circuit emulators, known as Dice, by Kokusai's emulator division which trades under the name of Dux.

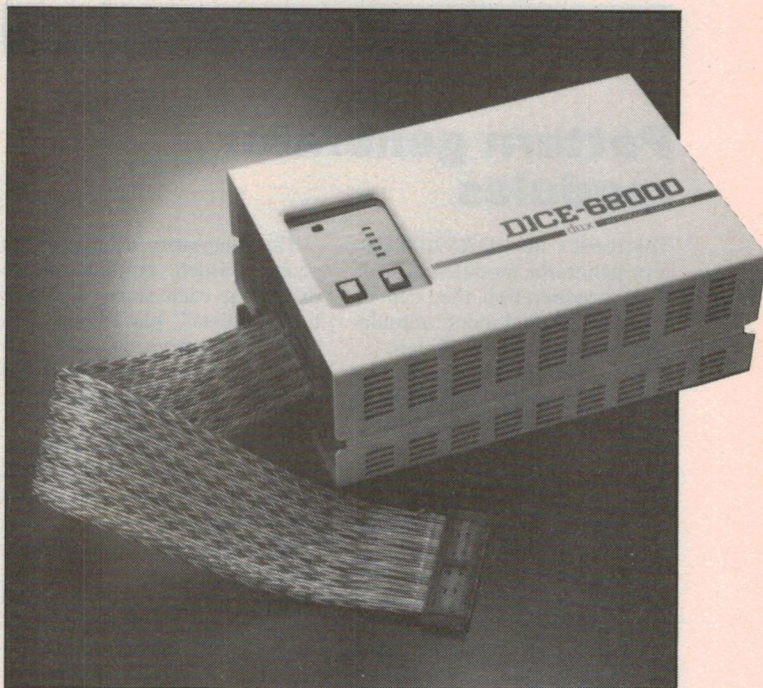
Dux has two series of products of interest to the design engineer.

The integral series features a built-in VDU and floppy storage, and incorporates powerful emulation for development work. Software break points are available, with other diagnostic features allowing the user speedy progress to the target. On successful completion of a

debugging session the Integral series provides a PROM programmer for the final product.

The Dice range of emulators includes emulation of the better known micros including Z80, 8085, 8048/9 and 8050, 8086/7/8, 68000, 68008, 68010, 6809 and 6502. Still to be released are emulators for the 80186, 80188, 8051 and 68020. The Dice range provides features such as real-time trace up to 10 MHz, hardware break with zero overrun and built-in time counter.

Alfatron Pty Ltd provides data on the Dux range and can be contacted at **1761 Ferntree Gully Rd, Ferntree Gully, Vic 3156. (03)758-9000.**



## BRIEFS

### Miniature Fan

Micronel's low noise miniature fan, with overall diameter of 30 mm and length 36 mm, is available in 6, 12 and 24 Vdc versions. Current drain is 100 mA for the 12 V model. For more details, contact Crusader Electronic Components, 81 Princess Highway, St Peters, NSW 2044.

### Electronic packaging

Amtron Tyree is marketing the Schroff brand of electronic packaging in Australia. A wide range of cabinets, cases, trolleys, racks and accessories is available, including 19" cabinets, 19" cases, subracks and sub-rack plug-in units. For more information contact Amtron Tyree, 176 Cope St, Waterloo, NSW 2017.

### PC-based CAD cell package

RIFA has a new low-cost IBM PC-based computer-aided design (CAD) software package, Sceptre II, for the design of custom integrated circuits using standard cell and gate array technology. Sceptre II allows design engineers to enter the complete logic diagram in schematic form and verify operation using the logic simulator.

### Conductive table top

Micastat, a heat and chemical resistant laminate for static control in electronics, provides protection where static sensitive devices such as MOS, CMOS and microprocessors are handled. It dissipates a 500 V static charge to zero in less than 0.05 seconds. Micastat is available from Royston Electronics, 27 Normanby Rd, Notting Hill, Vic 3168, or 15/59 Moxon Rd, Punchbowl, NSW 2196.

### Remote control via mains

Lemic Advanced Electronics has released an Australian designed and manufactured system that enables a wide range of microcomputers to control electrical devices by remote control. It consists of an interface-transmitter and up to 30 low

cost receivers; it uses existing 240 Vac wiring as a communication link between the transmitter and the receivers. Lemic is at 135 Roseneath St, North Geelong, Vic 3215.

### Test clip catches bugs

Emulation Technology's pin-grid-array test clip, the Bug Catcher II, is compatible with JEDEC standard PGA packages, has easily accessible test points and is convertible to leadless/plastic chip carriers. It can be used with oscilloscopes, logic analyzers and other test equipment, and is available from Pro-Log (Australia), PO Box 1, Canterbury, Vic 3126.

### Digital multimeter

The MIC-7000FA digital multimeter with frequency counter up to 200 kHz has been released by J. C. Tanloden. Features include compact size and only one rotary switch for easy selecting function. For more information contact J. C. Tanloden, 11 Stroma Ave, Balwyn North, Vic, 3104.

### Hybrid power converter

National Semiconductor has introduced a micro-switching, off-line power converter that, with a few external components, provides a four-fold power density increase over typical switching power supplies. Called the HS9151, it uses a 1 MHz pulse width modulator as a controller.

### Approval for ac noise filter

Murata's low cost 5 amp 250 Vac noise filter has received a State Electricity Commission of Victoria certificate of suitability. Features include quick connect or solder terminals, a 5 amp rating at 250 Vac and attenuation of 40 dB over 0.8-30 MHz. For more details contact IRH Components, 32 Parmatatta Rd, Lidcombe, NSW 2141.

### Information on switching regulators

Exar's new data book on switching regulators contains a summary of technical information about switching regulator IC products as well as several design and application notes and a review of fundamentals of pulse-width regulators. Copies are available from Total Electronics, 9 Harker St, Burwood, Vic 3125.

### Pattern generator modules

Tektronix's new DAS9100 pattern generator modules provide pattern generation that can be used as a stand-alone stimulation source in digital design.

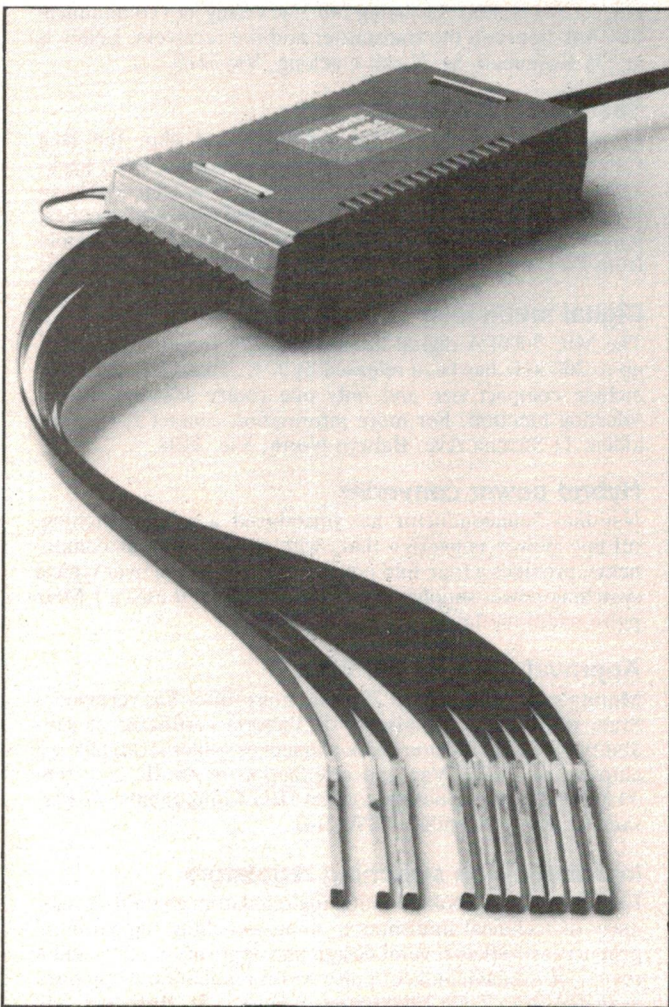
The modules can also be linked with data acquisition to provide a test system for debugging and verifying digital components, boards and systems. This link is available in the DAS9000 series of Digital Analysis Systems.

Speed and accuracy are also claimed as features of these modules, with 50 MHz output clock and data rates providing the speed, and new probes providing the accuracy of timing and signal fidelity.

The generators include output probes which contain active drivers at each separate probe tip. "Podlets", placed less than 100 ps away from the user's circuit, mean that users need not concern themselves with transmission line problems.

The new podlets support 10KH ECL and 74ALS TTL using the same pod/podlet combination.

More information about these pattern generators can be obtained from **Tektronix, 80 Waterloo Rd, North Ryde, NSW 2113. (02)888-7066.**



### Wire-wrap

Cooper Tools, known for its Weller brand of soldering equipment, is now marketing products for solderless connections for the electronics production and telecommunications industries. This development follows the transfer to Cooper Tools of the wire-wrap business from Gardner-Denver, a sister company in the Cooper Industries Corporation.

The technique of wire-wrap has a number of benefits that satisfy applications where soldering is not always suitable. Such applications include high density connections and connec-

tions subject to stress, vibration, corrosive atmosphere or significant changes in temperature. In addition, wire-wrapped connections can be easily removed and re-wrapped.

A comprehensive selection of electrically and air-powered tools as well as manual tools is included in the wire-wrap range, together with strapping, cutting and skinning, unwrap tools and accessories.

For further information about wire-wrap contact **The Cooper Tool Group Limited, Nurigong St, Albury, NSW 2640. (060)21-5511.**

### Pocket multimeter

Parameters has released a new pocket multimeter, the YEW 2447 Digital Circuit Tester, which features excellent integrated circuit design, two types of carry case and replaceable probe tips. Ranges include Vdc 2-500 V, Vac 2-500 V and resistance 2K ohm to 2000K ohm. The instrument is low cost and has data hold and continuity test

functions. Its size makes it ideal for routine checking maintenance and field service use.

A detailed brochure on the YEW 2447 Digital Circuit Tester is available from **Parameters Pty Ltd, Sydney and Melbourne, or by writing to 41 Herbert St, Artarmon, NSW 2064. (02)439-3288.**

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ICL7116 19.50	74H78 1.90	74LS145 2.10	A0570 69.50	MMS369 4.95	MPS443 1.20	2N5831 3.00	74193 1.80	74F139 1.79	8038 6.50	4553 5.50
ICL7117 21.50	74H87 2.50	74LS147 2.50	A07524 15.50	SC78 1.50	MPS445 1.00	2N5873 1.40	74194 1.10	74F151 1.79	8038 6.50	4553 5.50
ICL7611 6.95	74H101 1.80	74LS148 1.90	AY-3-8910 14.50	TRIALCS 1.90	MPS455 1.00	2N5874 1.70	74195 1.00	74F151 1.79	8038 6.50	4553 5.50
ICL7612 6.95	74H102 1.80	74LS151 1.20	AY-3-8910 14.50	TRIALCS 1.90	MPS456 1.00	2N5875 1.70	74196 1.00	74F151 1.79	8038 6.50	4553 5.50
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ICM7211 12.50	74H110 1.10	74LS155 1.00	MSM5830 14.50	SC146D 2.85	MPS493 1.00	2N6027 1.00	75107 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7216A 48.50	74H113 7.90	74LS156 1.00	MSM5830 14.50	SC150D 2.85	MPS494 1.00	2N6028 1.00	75108 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7216B 44.50	74C00 .50	74LS157 1.10	MSM5830 14.50	SC152D 2.85	MPS495 1.00	2N6029 1.00	75109 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7217A 18.50	74C02 .60	74LS158 1.00	LH0024CH 9.50	CI315Y 9.00	MPS496 1.00	2N6030 1.00	75110 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7218A 18.50	74C04 .80	74LS159 1.00	74C150 1.00	CI316Y 9.00	MPS497 1.00	2N6031 1.00	75111 2.50	74F182 2.73	8038 6.50	4553 5.50
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ICM7227A 19.95	74C32 .80	74LS162 2.45	LH0171 9.50	CI326D 8.50	MPS505 1.75	2N6034 1.00	75114 2.50	74F182 2.73	8038 6.50	4553 5.50
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ICM7240 7.50	74C74 1.70	74LS164 1.10	LH0191 9.50	CI326D 8.50	MPS507 1.75	2N6036 1.00	75116 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7242 3.90	74C76 1.90	74LS165 1.10	LH0201 9.50	CI326D 8.50	MPS508 1.75	2N6037 1.00	75117 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7250 7.50	74C83 2.30	74LS166 1.10	LH0211 9.50	CI326D 8.50	MPS509 1.75	2N6038 1.00	75118 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7260 7.90	74C84 2.30	74LS167 1.10	LH0221 9.50	CI326D 8.50	MPS510 1.75	2N6039 1.00	75119 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7555 2.75	74C86 1.50	74LS168 1.10	LH0231 9.50	CI326D 8.50	MPS511 1.75	2N6040 1.00	75120 2.50	74F182 2.73	8038 6.50	4553 5.50
ICM7556 2.95	74C89 8.90	74LS169 1.10	LH0241 9.50	CI326D 8.50	MPS512 1.75	2N6041 1.00	75121 2.50	74F182 2.73	8038 6.50	4553 5.50
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74S05 1.00	74C151 4.20	74LS243 1.90	10M10CH 1.50	AF126 2.90	MPS518 1.75	2N6047 1.00	75127 2.50	74F182 2.73	8038 6.50	4553 5.50
74S08 1.00	74C154 6.50	74LS244 1.90	10M302H 1.50	BC108 5.00	MPS519 1.75	2N6048 1.00	75128 2.50	74F182 2.73	8038 6.50	4553 5.50
74S09 1.50	74C155 1.90	74LS245 2.60	10M302H 1.50	BC108 5.00	MPS520 1.75	2N6049 1.00	75129 2.50	74F182 2.73	8038 6.50	4553 5.50
74S10 1.00	74C156 1.90	74LS246 2.60	10M302H 1.50	BC108 5.00	MPS521 1.75	2N6050 1.00	75130 2.50	74F182 2.73	8038 6.50	4553 5.50
74S11 1.00	74C157 1.90	74LS247 1.30	10M302H 1.50	BC108 5.00	MPS522 1.75	2N6051 1.00	75131 2.50	74F182 2.73	8038 6.50	4553 5.50
74S12 1.00	74C158 1.90	74LS248 1.30	10M302H 1.50	BC108 5.00	MPS523 1.75	2N6052 1.00	75132 2.50	74F182 2.73	8038 6.50	4553 5.50
74S13 1.00	74C159 1.90	74LS249 1.30	10M302H 1.50	BC108 5.00	MPS524 1.75	2N6053 1.00	75133 2.50	74F182 2.73	8038 6.50	4553 5.50
74S14 1.00	74C160 1.90	74LS250 1.30	10M302H 1.50	BC108 5.00	MPS525 1.75	2N6054 1.00	75134 2.50	74F182 2.73	8038 6.50	4553 5.50
74S15 1.00	74C161 1.90	74LS251 1.30	10M302H 1.50	BC108 5.00	MPS526 1.75	2N6055 1.00	75135 2.50	74F182 2.73	8038 6.50	4553 5.50
74S16 1.00	74C162 1.90	74LS252 1.30	10M302H 1.50	BC108 5.00	MPS527 1.75	2N6056 1.00	75136 2.50	74F182 2.73	8038 6.50	4553 5.50
74S17 1.00	74C163 2.00	74LS253 1.30	10M302H 1.50	BC108 5.00	MPS528 1.75	2N6057 1.00	75137 2.50	74F182 2.73	8038 6.50	4553 5.50
74S18 1.00	74C164 2.00	74LS254 1.30	10M302H 1.50	BC108 5.00	MPS529 1.75	2N6058 1.00	75138 2.50	74F182 2.73	8038 6.50	4553 5.50
74S19 1.00	74C165 2.00	74LS255 1.30	10M302H 1.50	BC108 5.00	MPS530 1.75	2N6059 1.00	75139 2.50	74F182 2.73	8038 6.50	4553 5.50
74S20 1.00	74C166 2.00	74LS256 1.30	10M302H 1.50	BC108 5.00	MPS531 1.75	2N6060 1.00	75140 2.50	74F182 2.73	8038 6.50	4553 5.50
74S21 1.00	74C167 2.00	74LS257 1.30	10M302H 1.50	BC108 5.00	MPS532 1.75	2N6061 1.00	75141 2.50	74F182 2.73	8038 6.50	4553 5.50
74S22 1.00	74C168 2.00	74LS258 1.30	10M302H 1.50	BC108 5.00	MPS533 1.75	2N6062 1.00	75142 2.50	74F182 2.73	8038 6.50	4553 5.50
74S23 1.00	74C169 2.00	74LS259 1.30	10M302H 1.50	BC108 5.00	MPS534 1.75	2N6063 1.00	75143 2.50	74F182 2.73	8038 6.50	4553 5.50
74S24 1.00	74C170 2.00	74LS260 1.30	10M302H 1.50	BC108 5.00	MPS535 1.75	2N6064 1.00	75144 2.50	74F182 2.73	8038 6.50	4553 5.50
74S25 1.00	74C171 2.00	74LS261 1.30	10M302H 1.50	BC108 5.00	MPS536 1.75	2N6065 1.00	75145 2.50	74F182 2.73	8038 6.50	4553 5.50
74S26 1.00	74C172 2.00	74LS262 1.30	10M302H 1.50	BC108 5.00	MPS537 1.75	2N6066 1.00	75146 2.50	74F182 2.73	8038 6.50	4553 5.50
74S27 1.00	74C173 2.00	74LS263 1.30	10M302H 1.50	BC108 5.00	MPS538 1.75	2N6067 1.00	75147 2.50	74F182 2.73	8038 6.50	4553 5.50
74S28 1.00	74C174 2.00	74LS264 1.30	10M302H 1.50	BC108 5.00	MPS539 1.75	2N6068 1.00	75148 2.50	74F182 2.73	8038 6.50	4553 5.50
74S29 1.00	74C175 2.00	74LS265 1.30	10M302H 1.50	BC108 5.00	MPS540 1.75	2N6069 1.00	75149 2.50	74F182 2.73	8038 6.50	4553 5.50
74S30 1.00	74C176 2.00	74LS266 1.30	10M302H 1.50	BC108 5.00	MPS541 1.75	2N6070 1.00	75150 2.50	74F182 2.73	8038 6.50	4553 5.50
74S31 1.00	74C177 2.00	74LS267 1.30	10M302H 1.50	BC108 5.00	MPS542 1.75	2N6071 1.00	75151 2.50	74F182 2.73	8038 6.50	4553 5.50
74S32 1.00	74C178 2.00	74LS268 1.30	10M302H 1.50	BC108 5.00	MPS543 1.75	2N6072 1.00	75152 2.50	74F182 2.73	8038 6.50	4553 5.50
74S33 1.00	74C179 2.00	74LS269 1.30	10M302H 1.50	BC108 5.00	MPS544 1.75	2N6073 1.00	75153 2.50	74F182 2.73	8038 6.50	4553 5.50
74S34 1.00	74C180 2.00	74LS270 1.30	10M302H 1.50	BC108 5.00	MPS545 1.75	2N6074 1.00	75154 2.50	74F182 2.73	8038 6.50	4553 5.50
74S35 1.00	74C181 2.00	74LS271 1.30	10M302H 1.50	BC108 5.00	MPS546 1.75	2N6075 1.00	75155 2.50	74F182 2.73	8038 6.50	4553 5.50
74S36 1.00	74C182 2.00	74LS272 1.30	10M302H 1.50	BC108 5.00	MPS547 1.75	2N6076 1.00	75156 2.50	74F182 2.73	8038 6.50	4553 5.50
74S37 1.00	74C183 2.00	74LS273 1.30	10M302H 1.50	BC108 5.00	MPS548 1.75	2N6077 1.00	75157 2.50	74F182 2.73	8038 6.50	4553 5.50
74S38 1.00	74C184 2.00	74LS274 1.30	10M302H 1.50	BC108 5.00	MPS549 1.75	2N6078 1.00	75158 2.50	74F182 2.73	8038 6.50	4553 5.50
74S39 1.00	74C185 2.00	74LS275 1.30	10M302H 1.50	BC108 5.00	MPS550 1.75	2N6079 1.00	75159 2.50	74F182 2.73	8038 6.50	4553 5.50
74S40 1.00	74C186 2.00	74LS276 1.30	10M302H 1.50	BC108 5.00	MPS551 1.75	2N6080 1.00	75160 2.50	74F182 2.73	8038 6.50	4553 5.50
74S41 1.00	74C187 2.00	74LS277 1.30	10M302H 1.50	BC108 5.00	MPS552 1.75	2N6081 1.00	75161 2.50	74F182 2.73	8038 6.50	4553 5.50
74S42 1.00	74C188 2.00	74LS278 1.30	10M302H 1.50	BC108 5.00	MPS553 1.75	2N6082 1.00	75162 2.50	74F182 2.73	8038 6.50	4553 5.50
74S43 1.00	74C189 2.00	74LS279 1.30	10M302H 1.50	BC108 5.00	MPS554 1.75	2N6083 1.00	75163 2.50	74F182 2.73	8038 6.50	4553 5.50
74S44 1.00	74C190 2.00	74LS280 1.30	10M302H 1.50	BC108 5.00	MPS555 1.75	2N6084 1.00	75164 2.50	74F182 2.73	8038 6.50	4553 5.50
74S45 1.00	74C191 2.00	74LS281 1.30	10M302H 1.50	BC108 5.00	MPS556 1.75	2N6085 1.00	75165 2.50	74F182 2.73	8038 6.50	4553 5.50
74S46 1.00	74C192 2.00	74LS282 1.30	10M302H 1.50	BC108 5.00	MPS557 1.75	2N6086 1.00	75166 2.50	74F182 2.73	8038 6.50	4553 5.50
74S47 1.00	74C193 2.00	74LS283 1.30	10M302H 1.50	BC108 5.00	MPS558 1.75	2N6087 1.00	75167 2.50	74F182 2.73	8038 6.50	4553 5.50
74S48 1.00	74C194 2.00	74LS284 1.30	10M302H 1.50	BC108 5.00	MPS559 1.75	2N6088 1.00	75168 2.50	74F182 2.73	8038 6.50	4553 5.50
74S49 1.00	74C195 2.00	74LS285 1.30	10M302H 1.50	BC108 5.00	MPS560 1.75	2N6089 1.00	75169 2.50	74F182 2.73	8038 6.50	4553 5.50
74S50 1.00	74C196 2.00	74LS286 1.30	10M302H 1.50	BC108 5.00	MPS561 1.75	2N6090 1.00	75170 2.50	74F182 2.73	8038 6.50	4553 5.50
74S51 1.00	74C197 2.00	74LS287 1.30	10M302H 1.50	BC108 5.00						

# Sight & Sound Kits

## AUDIO

### Playmaster Series 200 Mosfet (100W)

This is the one you've been waiting for. The all-new Playmaster Series 200 Integrated Amplifier is almost certainly the best build-it-yourself design to be published anywhere in the world! Feature for feature, dollar for dollar, it more than stacks up against the 'big names' in hi fi - with the big price tags to match.

And it has features that aren't even found on many of the 'names'. Features like electronic input switching. Circuitry to handle just about every input imaginable; moving magnet cartridge, CD player, hi fi VCR, cassette, tuner, etc etc. Plus, of course, incredible 'headroom' with 100 watts per channel output power. And much, much more! Cat K-3516

**\$439**

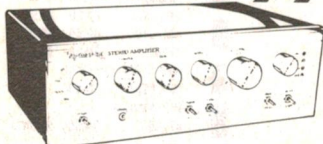


### Playmaster 45W

A little less power... a lower price: that's the original Playmaster Mosfet Integrated Stereo Amplifier, as described in Electronics Australia magazine.

With a very respectable 45 watts per channel output (enough to blow your head off!) it has most of the features of its big brother above: all components are on a single pcb, which makes construction quite simple. And the sturdy chassis and solid heatsinking make it ruggedly reliable. It includes integral speaker protection on board, along with fuse protection against massive overload. And our kit features a professionally designed front panel designed to suit today's modern hi fi decor. Cat K-3515

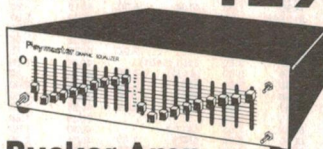
**\$199**



### Playmaster Graphic Equaliser

Get total control and flexibility with your sound system. With cut and boost of up to 13dB per channel you can make up for deficiencies in your listening area or sound source or even create special effects. (Big, booming bass: bewdy!) You can even make equalised tapes of those precious records. Features professional quality brushed aluminium front panel. Cat K-3500

**\$129**



### Busker Amp

Easy-to-build general purpose microphone/guitar preamp & power amplifier, ready to build into a speaker case for a go-anywhere mini pa!

Ideal for the budding buskers in the family. Also fantastic for displays, fetes, rallies, etc.

Includes components, speaker but we leave the case to you (if you want to use away from power point you'll also need a 12V gel cell. (Cat S-3320).

Cat K-3446



**GREAT VALUE**

**\$79<sup>95</sup>**

CASE SHOWN NOT INCLUDED

### 50W Amp Module

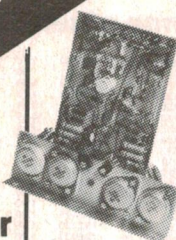
Ideal for home stereo systems. Same design simplicity as the 100 watt module above, but cheaper because of lower power. And there's added economy as two units can be run from the one K-3438 power supply. An economical solution for those who want to update their old system without a huge outlay of money. Input sensitivity is 500mV. Supplied with exclusive instruction booklet and rugged fibreglass PCB with silk-screened component overlay for easy assembly. Heatsink bracket is supplied but heatsink itself is extra. Cat K-3440

**\$22<sup>95</sup>**



### 100W Amplifier Module

100 watts RMS; 100db signal to noise ratio at 5kHz: That's the ETI 480 amplifier. The ultimate in simplicity; even the power transistors mount on the one PCB. The PCB heatsink bracket is supplied, and the heavy duty fibreglass PCB has a silk-screened overlay to make the construction even easier! Cat K-3442



**\$26<sup>95</sup>**

### Power Supply

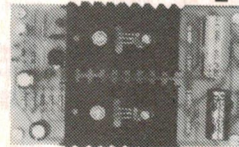
Full PCB and component kit for one K-3442 or two K-3440 modules. Supplied complete with speaker dethump relay and Zener regulated plus & minus 15V preamp rails. Special assembly instructions supplied. Cat K-3438

**\$21<sup>95</sup>**

### 20 Watt Amp Module

A general purpose amp as used in television, tape players, musical instruments, sound projectors, etc. A handy device for any hobbyist to add to his work bench. Uses discrete transistors for reliability which provide the ideal opportunity for the hobbyist to gain an understanding of how an audio amp works. Cat K-3445

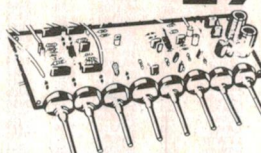
**\$15<sup>95</sup>**



### Mixer Pre-amp

Designed to suit the 300W amp kit, this mixer preamp has 4 inputs with an impedance of 100K - suitable for most microphones, guitars, etc. Ideal also for use with 50W (K-3400) and 100W (K-3442) power amp modules. This unit provides bass, treble and presence control. Instructions supplied. Short form kit: no case, transformer or power supply. Cat K-3035

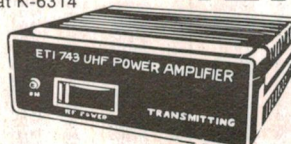
**\$29<sup>95</sup>**



### UHF Power Amp

Now a power amplifier to UHF AMATEUR AND CB radio. A very healthy 25 watts output from virtually any UHF input (from around 300mW or so.) And that could make the difference between being heard or not. The amplifier kit is complete to the last nut and bolt - including the same deluxe case used in our UHF amateur transceiver, and its matching power supply. Cat K-6314

**\$129**

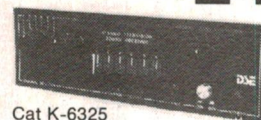


## STEREO

### Stereo TV Decoder

TV sound can be very high quality - especially now it's being transmitted in stereo. But 99.9% of TV sets can't take advantage of this because they're only equipped for mono sound. And 99.9% of people aren't willing to get rid of a perfectly good colour telly just to get stereo sound! Here's the Dick Smith Electronics-low-cost-solution.

**\$249**



Cat K-6325

## VIDEO

### Teletext Decoder

Another money-saving kit from Dick Smith Electronics, bringing you the latest in technology at a fraction of the normal cost.

All you need is this adaptor to pluck out the information, and hold it for display on the TV screen. You can have Teletext only, or a mix of Teletext and picture, or even news flashes and, perhaps most important of all, captions for the deaf on many programs.

We've kept the price way, way down by designing this Teletext converter to be used in conjunction with a VCR.

Cat K-6315

Check with your local TV station(s) to ensure Teletext or captions are being transmitted before commencing construction!



**ONLY \$229**

### Musicolor Mk IV

What's better than a colour organ and a chaser? The Musicolor MkIV: combines both in one unit! Four chase patterns plus auto chase and reverse chase AND four channel colour organ with built-in microphone (no connection to speakers necessary!) means you're ready to stage a lightshow! Cat K-3143

**\$109**

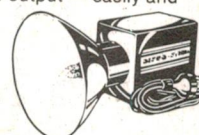


### Disco Strobe

A must for parties, dances, discos, etc. One of the most popular kits we have ever stocked. Includes a specially designed printed circuit board for all the components, PLUS provision for adding an extra tube to double the light output - easily and economically.

Cat K-3152

**ONLY \$39<sup>95</sup>**



45

# High output current op-amp

RIFA has released a versatile operational amplifier from Precision Monolithics (PMI), which offers a higher open-loop voltage gain than current industry-standard monolithic op-amps.

Called the OP-50, this new product is suitable for a wide range of applications, especially where high closed-loop gains are required. It combines precision op-amp performance with the output characteristics of a power buffer in the  $\pm 50$  mA output range, and also offers a high open-loop voltage gain. In addition to the guaranteed  $\pm 50$  mA drive into  $50 \Omega$ , the output is stable with capacitive loads of up to 10 nF.

RIFA claims the OP-50 has many specification improvements over PMI's industry-standard op-amp, the OP-27. These include CMRR and PSRR raised to more than 126 dB, input offset voltage and drift

lowered to 25  $\mu$ V and 0.3  $\mu$ V/ $^{\circ}$ C maximum respectively, input bias current lowered ten-fold to 5 nA max, and noise voltage of only 4.5 nV/ $\sqrt{\text{Hz}}$  at 1 kHz.

The OP-50 is stable for closed-loop gains above 50 and, with external compensation, is stable for gains between 5 and 50.

Slew-rate is 2.5 V/ $\mu$ s when fully compensated and increases to 7 V/ $\mu$ s without compensation. Input protection allows a  $\pm 10$  V differential overload and the output stage provides both current-limit and thermal-shutdown protection.

Further information is available from RIFA Pty Ltd, 202 Bell St, Preston, Vic 3072. (03)480-1211.



## Surface mounting caps

Tantalum caps keep getting smaller. Siemens now presents these capacitors in chip format (B 45 193) for automated pc board assembly. Five different case sizes provide capacitance values from 0.1 to 100  $\mu$ F and a voltage range from 6.3 to 50 V. They are available initially on indent.

This series is suitable to use as storage capacitors. Compared with the series B 45 181 tantalum capacitors with leads, the

volume of the largest capacitor is reduced from 900 to 200 cubic millimetres, that of the smallest type from 144 to 24 cubic millimetres.

The operating temperature range of the tantalum chip capacitors is between  $-55$  to  $+125^{\circ}\text{C}$ .

For further information contact Siemens, 544 Church St, Richmond, Vic 3121. (03)429-7111.

## 4 A switching regulator

A cost-effective replacement for costly hybrids, the SGS L296 power switching regulator delivers 4 A at an output voltage of 5.1 V to 40 V and includes functions which make it specially suited for micro-processor supply.

It is claimed to have eliminated the driving problem of the power control stage and give a higher overall efficiency; it is therefore also possible to operate directly at frequencies as

high as 100 kHz. Maximum operating input voltage is 46 V.

The L296 is mounted in a multi-watt plastic package with 15 pins, minimizing the cost per watt and allowing a low thermal resistance of  $3^{\circ}\text{C}/\text{W}$  between junction and package and of  $35^{\circ}\text{C}/\text{W}$  between junction and ambient.

For further information contact Ellistronics, 797 Springvale Road, Mulgrave, Vic 3170. (03)561-5844.

## Miniature relays

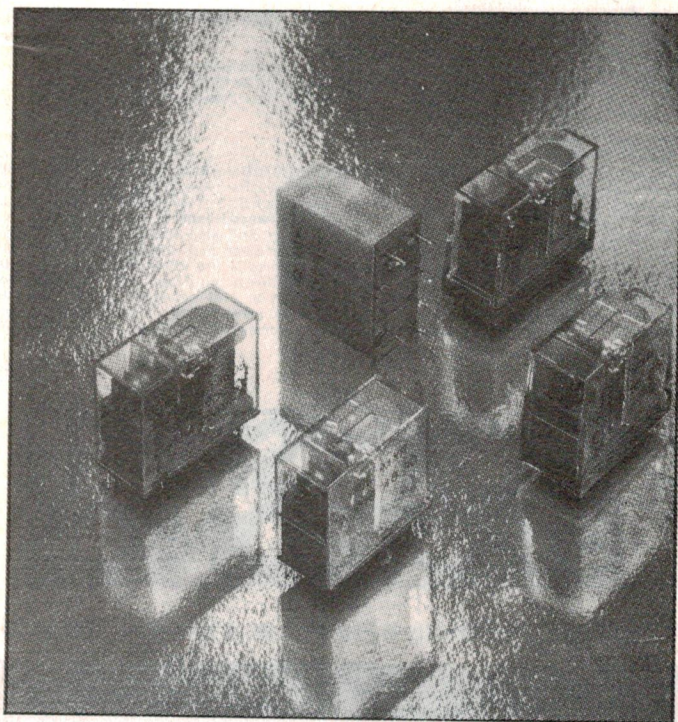
Feme has released two new versions of relay. The current 'M' series of relays is now available in the flux free version MZF and the sealed version MZH.

In the MZF version the relay base is resin finished to avoid the entry of fluxes or soldering fumes in the relay body through the base. It is particularly suitable for automatic wave soldering and partial-immersion

washing. The sealed relay is also suitable for operation in dusty or polluted surroundings.

These miniature pcb-mounted relays combine small physical size with sensitivity and high switching capability.

Feme is represented in Australia by Paton Electronics, 90 Victoria St, Ashfield, NSW, 2131.



## BRIEFS

### CHMOS integrated memory chip

Intel Australia Pty Ltd has CHMOS 8-kilobit-by-8-bit iRAMs (integrated random-access memory) which combine the low cost of a dynamic RAM with the user ease of a static RAM. An iRAM places all necessary control circuits on the chip, making their functions transparent to the user. For further information contact Intel, Level 6, 200 Pacific Hwy, Crows Nest, NSW 2065. (02) 957-2744.

### Triac opto-couplers

Promark Electronics Pty Ltd can supply Telefunken K3020P and CNR21 optically coupled triac drivers for coupling logic to power states. They can trigger the most powerful triacs and can be used for phase control or burst driving. For further information contact Promark, Suite 208, 6-8 Clarke St, Crows Nest, NSW 2065. (02) 439-6477.

### Stackable box connectors

Total Electronics has released a line of stackable box connectors on 100-inch grid spacing for pc board applications. Called "True Grid", these connectors have preloaded insulation displacement contacts (IDCs) and the terminations are flashed with gold. For further information contact Total Electronics, 9 Harker St, Burwood, Vic 3125. (03)288-4044.

### Small metal film capacitor

Philips has added several small-dimension series to its range of metallized film capacitors. Smaller versions of the 365 and 366 series have been developed with a capacitance value range of 0.0039 to 0.47  $\mu$ F, and a small pitch of just 5mm is available as well as existing pitches. Two new series, the 367 (2e and 3e) and 369 (4e), have straight-lead capacitors offering less height on the finished board. For more information contact Philips, 15 Blue St, North Sydney, NSW 2060.

### 1985 'Technicalities' catalogue

The 1985 edition of 'Technicalities' features 42 pages of components and test instruments including plugs, sockets, terminals, heatsinks, fuses/fuseholders, resistor networks, relays, supplies, chart recorders and sound level meters. Copies are available from Tecnico Electronics, 11 Waltham St, Artarmon, NSW 2064.

### Monolithic PCM CODEC/filters

CMOS  $\mu$ A3054 and  $\mu$ A3057 families consisting of  $\mu$ -law and A-law monolithic PCM CODEC/filters are available from the George Brown Electronics Group. The transmit portion of each device has an input gain adjust amplifier — an active RC pre-filter which eliminates very high frequency

noise prior to entering a switched-capacitor band-pass filter that rejects signals below 200 Hz and above 3400 Hz. Contact George Brash, 174 Parramatta Rd, Camperdown, NSW 2050. (02) 519-5855.

### LED socket flying leads

PS200 Series LED sockets with 6-inch flying leads, which can be specified with a built-in resistor for operation from 5 to 48 volts dc, are available from Ampec Electronics, 21 Bibby St, Chiswick, NSW 2046.

### Octal registered transceiver

F550 and F551 octal transceivers, each containing two 8-bit registers for temporary storage of data flowing in either direction, have been released by Fairchild Australia Pty Ltd. Each register has its own clock pulse and clock enable inputs as well as a flag flip-flop. Contact Fairchild, 366 Whitehorse Rd, Nunawading, Vic 3131.

### Fast 16K CMOS SRAMS

New 16K static CMOS RAMs featuring access times as fast as 45 ns, standby current of 0.5  $\mu$ A and protection against alpha particles are available from Sprague Electric. This 21C16 line is organized as 2K words by 8 bits and the low power allows full battery back-up. Sprague is at 56 Silverwater Rd, Auburn, NSW 2144.

### CMOS auto zero circuit

National Semiconductor has introduced the LMC669, an auto zero peripheral circuit that automatically and continuously corrects the offset voltage of an operational amplifier or any other linear circuitry. Offset voltage typically can be reduced to less than 5 microvolts. For information contact National Semiconductor, Mountain Hwy, Bayswater, Vic 3153. (03)729-6333.

### Electrolytic capacitors

Two long-life electrolytic capacitors by Elna, the RK (radial lead) and the TK (axial lead), are available from Soanar Electronics. Operating temperature is  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ , with standard tolerance  $\pm 20\%$ . The range covers 10-100 volts and 0.47-1000 microfarads. For further information contact Soanar, 30 Lexton Rd, Box Hill, Vic 3128. (03) 895-0222.



## Low dropout 1.5 A regulator

National Semiconductor has released a positive voltage regulator that has the ability to source 1.5 amps of output current with an input-output differential of typically 0.65 V. It's called the LM2940CT-5.0 and features an output current in excess of 1 amp.

With its high output current capability and low dropout volt-

age, the regulator is useful in applications where the input voltage is kept at a level within one or two volts of the output voltage. It is designed as a plug-in replacement for similar npn type regulators and is pin-for-pin compatible with the LM340. As well, it is guaranteed to be  $\pm 3$  per cent accurate at  $25^{\circ}\text{C}$ .

The LM2940CT-5.0 is suit-

able for battery-powered applications or for automotive applications where large transient voltages such as  $\pm 45$  V can be expected.

Other features of the regulator include low quiescent current, mirror image insertion protection, reverse battery protection and a trimmed output voltage. Further voltage options

including 12 V, 15 V and an adjustable version will be available in the future.

More details about this regulator can be obtained from National Semiconductor (Australia) Pty Ltd, 21/3 High St, Bayswater, Vic 3153. (03)729-6333.

# JAYCAR MOVING SALE SPEAKER PRICES LIKE YOU WOULDN'T BELIEVE...



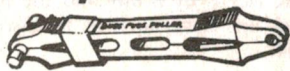
**PIONEER 12" WOOFER 90W RMS ONLY 200 AVAILABLE**  
Our best selling woofer. They won't last at this price. Limited quantity. Be quick. Beautiful white cone. **USUALLY \$65 SAVE \$26**  
Cat. CW-2128

★ Impedance 8 ohms ★ Power rating 90W RMS ★ Frequency response 23Hz - 2,000Hz ★ Resonant frequency 23Hz ★ Sensitivity 99dB/w 1/2 metre

## FUSE PULLER

Moulded, double-ended plastic fuse puller has wide grip on one end and a narrow grip on the other end. It fits all lengths of 1/4" diameter fuses. Makes it easy and safe to replace fuses in hard-to-reach fuse blocks. Removes and replaces fuses where fingers can't grasp them.  
Cat. SZ-2040

**\$3.95**



## AM/FM STEREO RADIO HEADPHONE

This is the latest rage! A quality AM/FM stereo radio built into a pair of headphones. They look and feel great.



**ONLY \$39.95**

## PIONEER DOME TWEETER LESS THAN 1/2 PRICE

A dome tweeter for under \$10! Ridiculous! Only 250 available.

**USUALLY \$18.50 SAVE \$9.55**

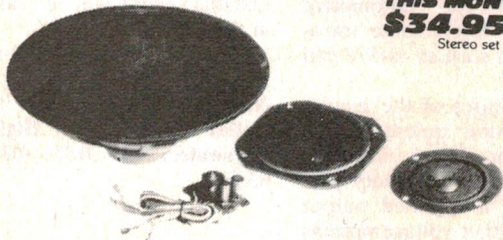
Cat. CT-2020

**PIONEER SAVE \$9.55 ONLY \$8.95**

## PIONEER 10" 3-WAY SPEAKER SYSTEM

A high quality 10" woofer with high power, sealed back grilles front midrange and tweeter. System impedance is 8 ohms. In addition a quality Pioneer 3-way crossover is provided at no extra charge. Connection instructions are also provided as well as recommended 10" cabinet plans.

**2 REQUIRED FOR STEREO INCLUDES PIONEER X'OVER USUALLY \$39.95 each set**



**PIONEER \$34.95 each**

**THIS MONTH ONLY \$34.95 each**

Stereo set \$69.90

## PIONEER HORN TWEETER

Great sounding black anodised square metal horn. Two together sound great. Limited quantity.

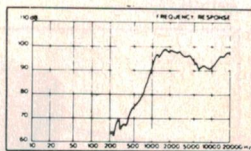
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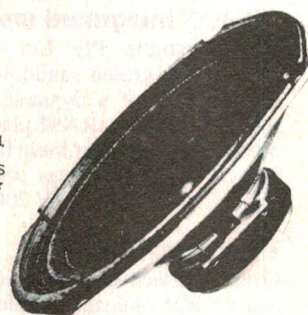
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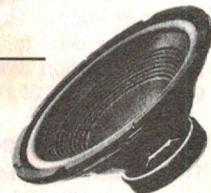
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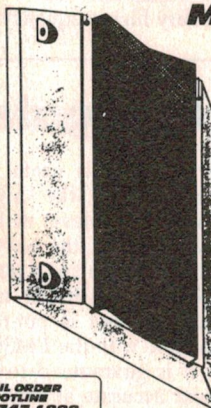
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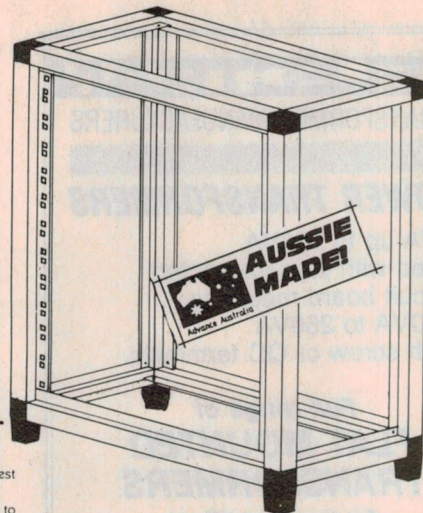
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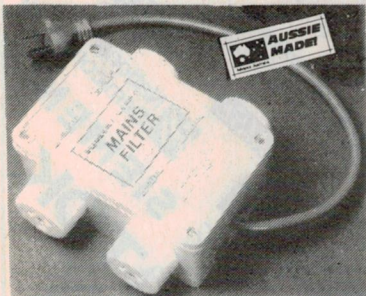
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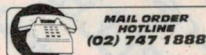
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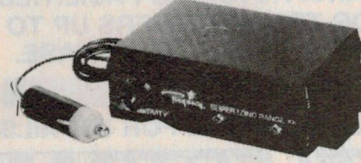
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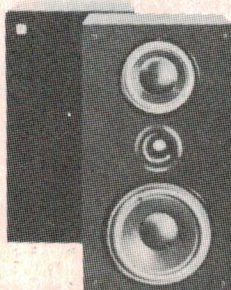
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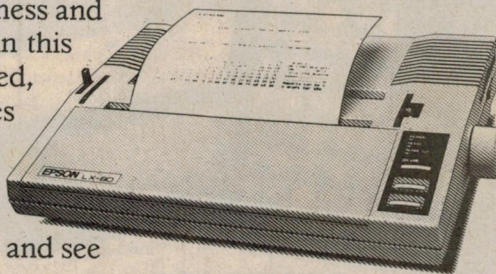
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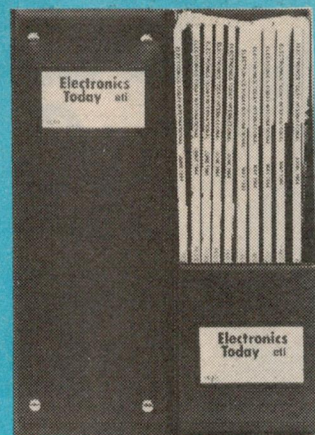


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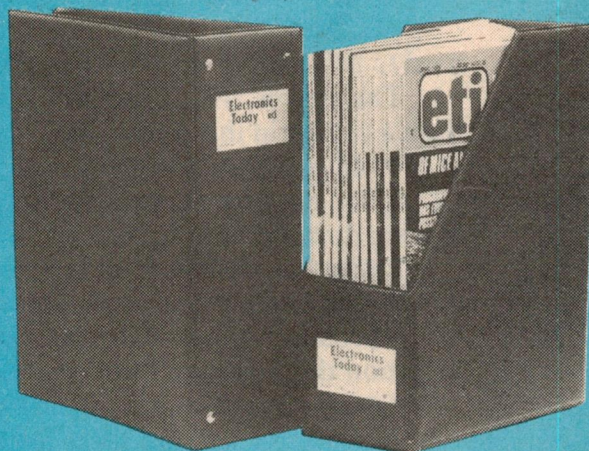
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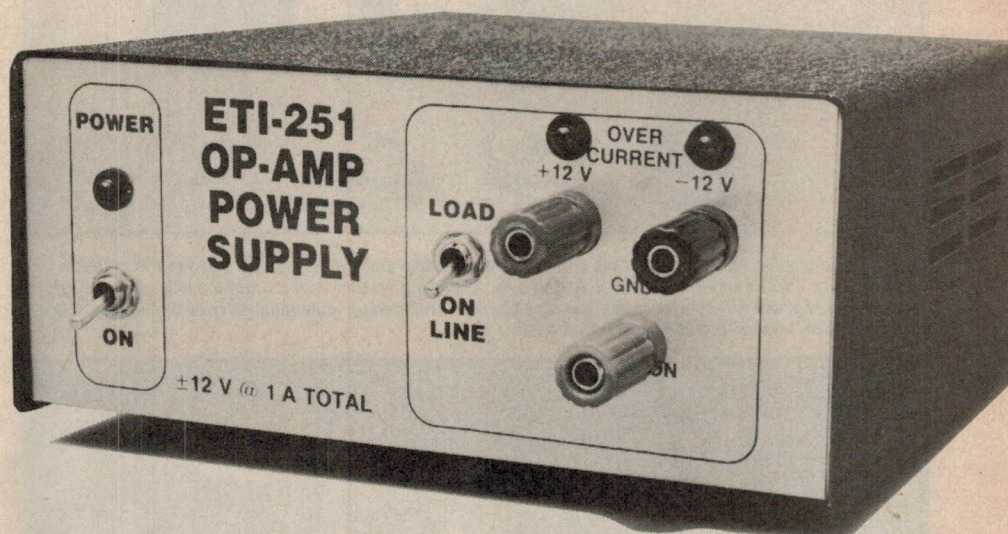
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Robert Irwin

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A DUAL RAIL supply is a handy piece of equipment for anyone who is even thinking of playing around with analogue ICs. The ETI-251 is a simple, easy-to-build, low cost supply that will be ideal for breadboarding up circuits which require single or split 12 V rails. The ETI-251 provides regulated positive and negative 12 V rails and can supply up to 0.5 A from each. An overload LED on each rail gives a visual indication when you try to draw too much current from the supply. All the components used are very common and most could probably be found in the average hobbyist's 'bits-and-pieces' draw. The supply is relatively easy to build and should be suitable for even inexperienced constructors, although not recommended as a very first project. The construction section has been made very detailed to accommodate any beginners who wish to build this supply.

## Design details

The circuit is designed around the very widely used LM7XXX series of three terminal regulators. The LM7812 and LM7912 provide +12 V and -12 V respectively. Both ICs have built in short circuit fold-back current limiting and thermal protection and are therefore very hardy devices. As well as the internal protection built in to the regulator ICs, several external protection diodes are included in the circuit to guard against any accidental load faults that may otherwise destroy the regulators.

The transformer used is a widely avail-

## HOW IT WORKS — ETI-251

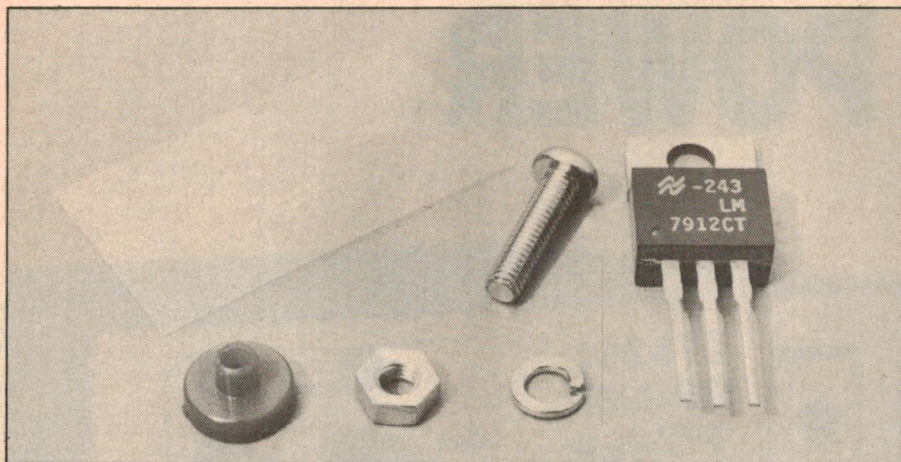
The circuit is very simple as the three terminal regulators are basically autonomous, requiring no external circuitry to make them work. Protection from unusual load conditions is needed though. Referring to the circuit diagram, the transformer output is 30 Vac with a centre tap. This gives two 15 Vac signals which are rectified by a D1, 2, 3, 4 which form a full wave bridge rectifier. This produces both a positive and a negative rectified output with reference to the centre tap. The rectified signals are smoothed by C1 and C2 which, with the values chosen, will give a peak output of 21 V and a ripple of about 4 V p-p at 1 A output.

Before going to the regulators, the current is monitored by the overcurrent circuitry. Both the positive and negative circuits are identical (except for the direction of current flow) so we will just look at the positive overcurrent circuit. R1 is in series with the supply current and will develop a voltage across it which is given by Ohm's law,  $V=IR$ . The emitter of Q1 is connected to the supply side of R1 and the base is connected to the load side. When the load current reaches 0.6 amps, 0.6 V is developed between the base and emitter of Q1 and it begins to turn on. This will allow current to flow through LED2 which will cause it to light and indicate an overcurrent condition. R5 limits the current through the LED to about 15 mA.

IC1 is a positive regulator which takes the unregulated input and gives a regulated +12 V output. IC2 does the same for the negative side and gives a regulated -12 V output. One problem that sometimes occurs when using regulators in a split rail supply is

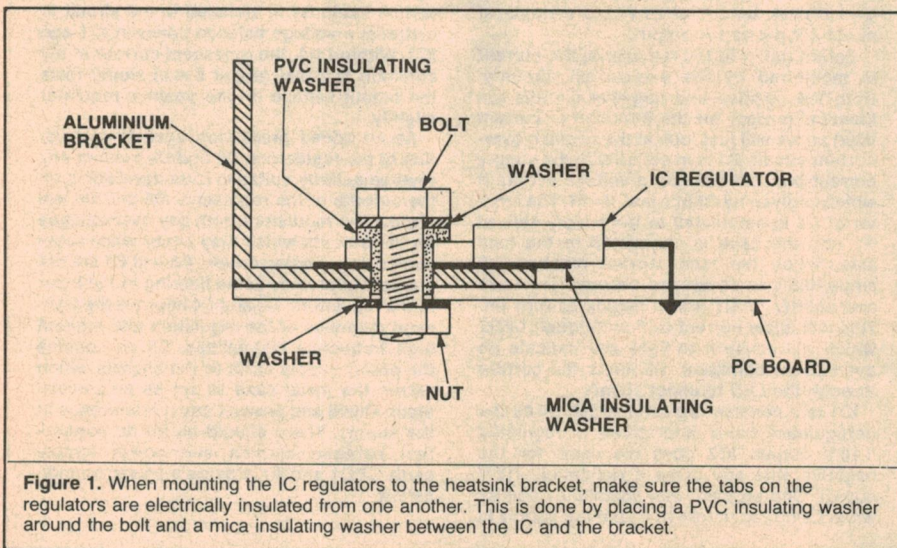
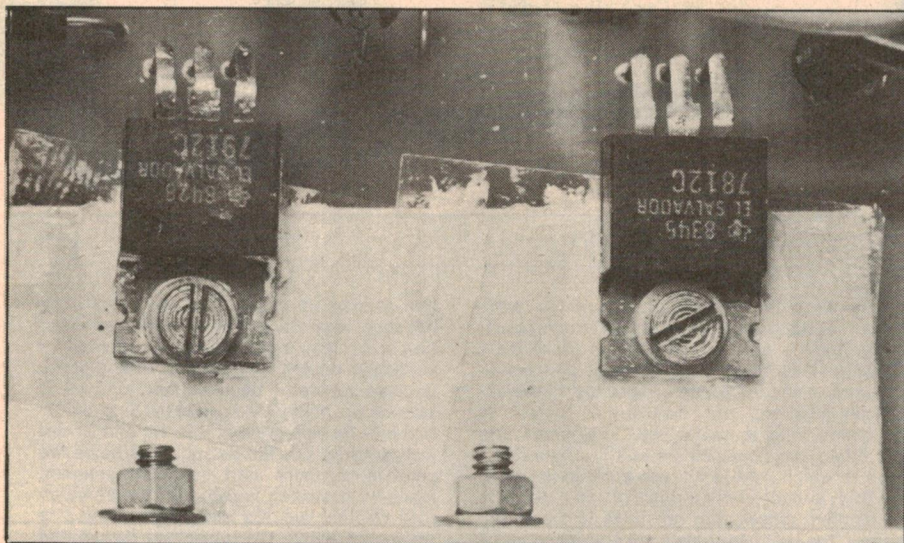
that of start up under a common load. The negative regulator tends to establish itself first and, under a shared load (particularly a capacitive one), it may drag the output of the positive regulator negative and prevent it starting up. It may also cause the IC to be destroyed. To help prevent this, R3 and D7 are incorporated into the design. This helps the positive regulator start up under common loads by providing isolation of the common pins on the two ICs and, if the output is dragged negative, the current can be shunted by D7 and allow the positive regulator to establish itself. R4 is included in the circuit to maintain a voltage balance between IC1 and IC2. Without R4, the quiescent current in the common terminal (about 6 mA) would raise the output voltage on the positive regulator slightly.

As an added precaution against destruction of the regulators, D8 and D9 prevent any reverse polarity voltages from developing on the outputs of the regulators. D5 and D6 will protect the regulators from any overvoltages on the outputs which may occur when reactive loads are being driven. C6 and C7 are not crucial but provide some filtering to the input of the regulators. C3 and C4 improve the transient response of the regulators and prevent high frequency instabilities. C5 ac couples the power supply earth to the chassis which allows the metal case to act as an electrostatic shield and prevent any rf interference in the supply. There should be no dc connection between chassis and power supply earth. LED1 and R7 provide a power on indication.



**Above:** IC mounting hardware. This pic shows the various bits and pieces you will need to mount each regulator. The mica washer is at the top left, and the insulating washer is at the bottom left.

**Below:** The regulators mounted on the heatsink bracket. The 'messy white stuff' all over the bracket is the thermal grease used to provide good heat transfer.



**Figure 1.** When mounting the IC regulators to the heatsink bracket, make sure the tabs on the regulators are electrically insulated from one another. This is done by placing a PVC insulating washer around the bolt and a mica insulating washer between the IC and the bracket.

able multi-tapped secondary type which provides 15 V and 30 V taps and is rated at 30 VA maximum. The main reason for the choice of this transformer is that it is cheap and easy to get. It should be noted however, that under a direct short circuit between the positive and negative terminals, the output current will be just over 2 A. The transformer will handle this sort of overload for quite a few minutes without damage but may heat up if the short is left for long periods. This will not be a problem in normal operation but if the supply were, for example, to be used to power a circuit which was to be left running overnight, it would be a good idea to use a transformer with a higher output current rating so that any sustained short that may occur will not thermally stress the transformer. A short from either the positive or negative to ground will only cause about an amp to flow and can be handled indefinitely by the specified transformer. A PL30/60 VA is an ideal substitute but is quite expensive. For most applications, though, the specified transformer will be more than adequate.

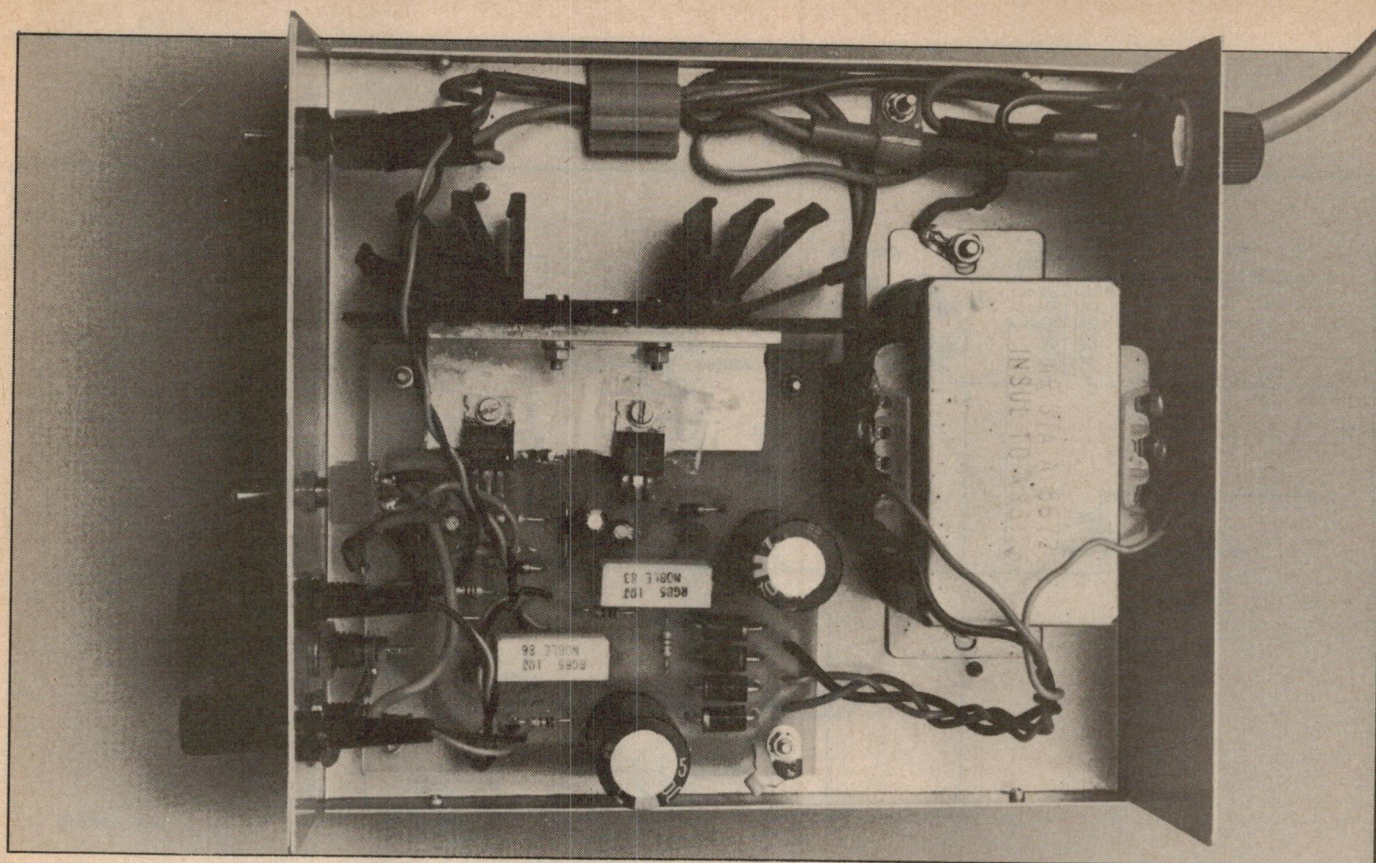
Incorporated into the design is an overload indication for each rail. This is set to indicate that a current of 0.6 A or more is being drawn from the rail. This overload in no way damages the supply but is there to indicate excessive current drain which may be cause to investigate the circuit you are powering for shorts.

## Construction

The construction of the power supply presents no real problems. However, I will describe the construction in detail for those who may not be as familiar with a soldering iron as others.

It is recommended that the circuit be constructed on the ETI pc board. If you wish (and you know what you're doing) you can, of course, use Veroboard or the like but using the pc board will greatly simplify construction and minimize the chance of a wiring error. Having said that, once you get a pc board check it very carefully for faults on the copper side. The most common faults are broken or shorted tracks caused by problems in the etching stage. If a track is thin, then over-etching or faults in the resist can cause the track to be etched away in parts and thus be open circuit, so check all thin tracks for breaks. Where two tracks come close together, under-etching or dust on the negative can cause the copper between the tracks to remain and thus cause a short so check all points where tracks come close together. Finally, check that all the holes have been drilled. Once you are satisfied that the pc board is in good shape, you can move on to the soldering in of the components.

Referring to the overlay diagram, locate the position of the wire link. This link



should be made on the pc board with a piece of tinned copper wire (a discarded piece of component lead is ideal). Once this is in position locate and solder in all the resistors. R1 and R2 are high power resistors and in the course of normal operation may get quite hot. To help cooling and to prevent scorching the board these two resistors should be mounted so that they stand off the board by about a millimetre or so. The parts list specifies 1 ohm, 5 watt resistors for R1 and R2 but two 2.2 ohm, 1 watt resistors in parallel can be substituted for each resistor if you wish. There are extra holes on the board to allow for this.

Next, locate and solder in all the capacitors. Take very special note of the way these are put in as they are polarized and may be destroyed rather spectacularly if they are put in the wrong way round. Note that C5 is only soldered to the board at one end. The other lead will be bolted to the pc board mounting bolt at a later stage. For the moment just leave it dangling over the side.

The semiconductors can be soldered next. Start with the diodes. Mount the large rectifier diodes off the board as you did with the power resistors as these too may get hot. Once again pay attention to the way the diodes go in as they are also polarized components.

The two transistors can now be soldered in. The only remaining components to mount are the IC regulators. These will be a bit of a problem in that they mount on an aluminium heatsinking bracket but must be electrically isolated from one another. The first thing to do is to prepare the bracket.

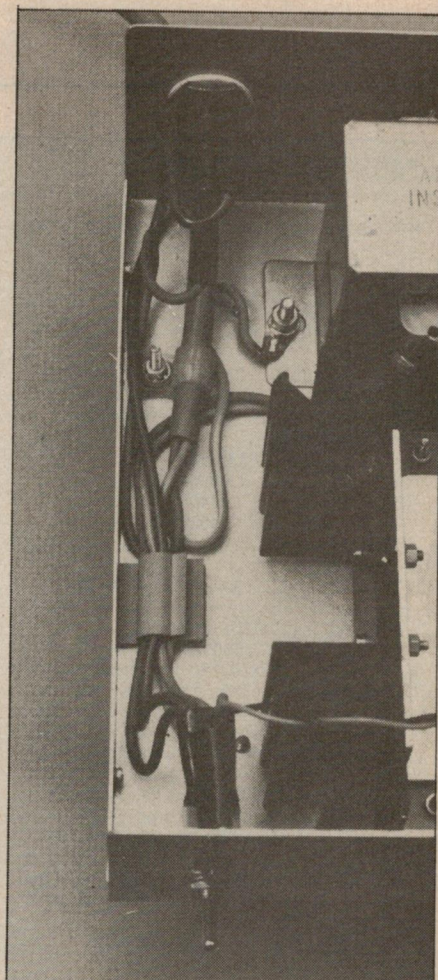
Cut a 70 mm length of 1 inch aluminium

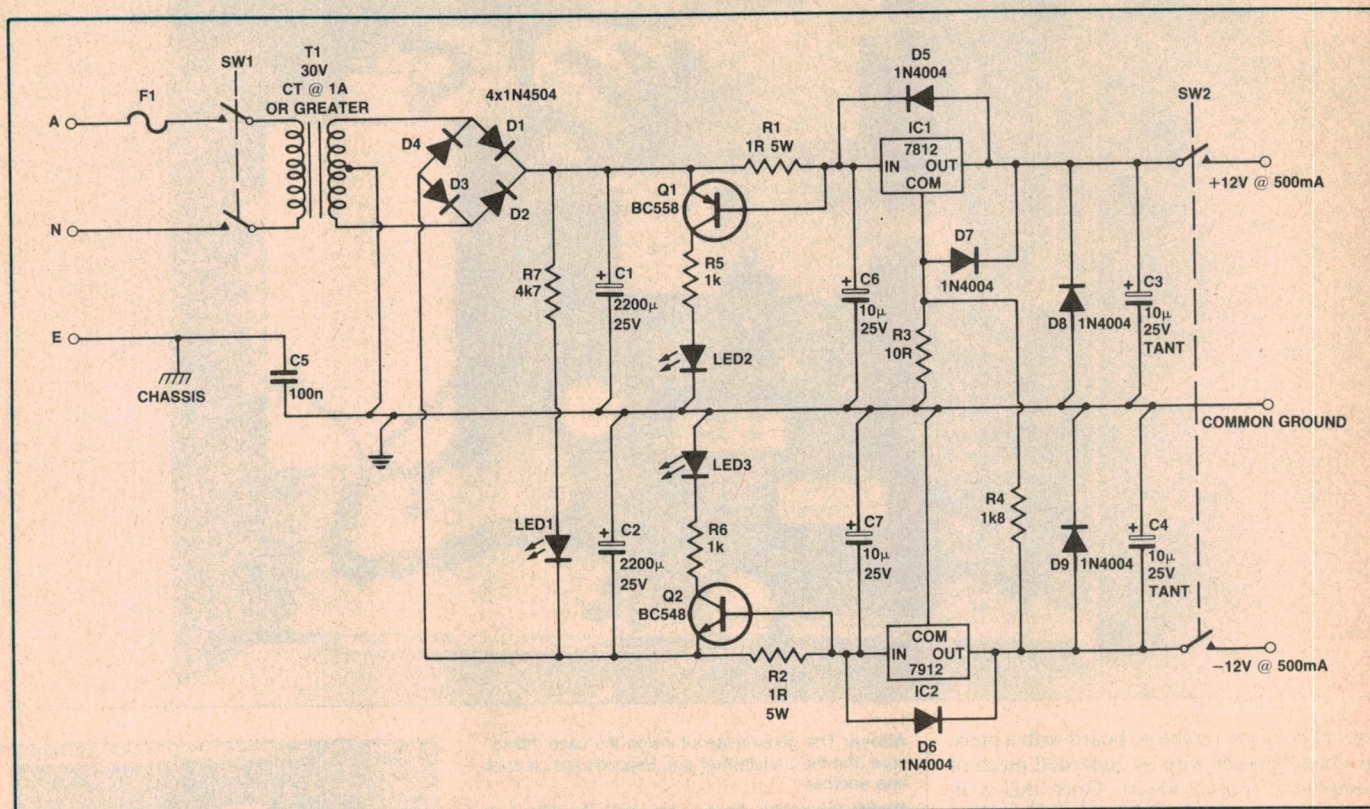
**Above:** The general layout inside the case. Make sure that the transformer and heatsink are clear of one another.

**Right:** The mains wiring is run down the left hand side of the box. Try to keep it neat and insulate all connectors on the fuse and switch so that you can't accidentally brush against a live terminal.

angle. Study the photographs and drawings and position the angle at the edge of the board so that it sits between the pc board mounting holes on the component side. The side should point upwards from the board. Use a felt pen or scribe to mark the position of the two mounting holes for the ICs. These holes should be drilled large enough to fit the IC mounting bolts. The heatsink (a 35 mm length of radial fin type) mounts vertically on the side of the aluminium angle. This should be positioned against the angle and the centres for two holes to mount the heatsink should be marked. It is best to drill the holes in the heatsink first and then use these to mark and drill the holes in the angle. This way they'll line up. All the holes in both the bracket and heatsink should be carefully de-burred and the edges made smooth. Thermal conduction to the heatsink is dependent on how well contact is made between the two surfaces. If the edge of the hole is rough it may prevent the two surfaces from contacting each other properly.

To mount the two ICs examine Figure 1 carefully. Position the bracket and lay the ICs on it. Bend the legs of the ICs in the appropriate place and push them through their mounting holes. Take a TO220 package mica mounting washer and thinly coat it on both sides with a layer of thermally conduc-





## PARTS LIST — ETI-251

### Resistors.....all 1/4 W, 5% unless noted

R1, 2.....	1R0, 5 watt
R3.....	10R
R4.....	1k8
R5, 6.....	1k
R7.....	4k7

### Capacitors

C1, 2.....	2200µ, 25 V, RB electro
C3, 4, 6, 7.....	10µ, 25 V tantalum
C5.....	100n ceramic bypass

### Semiconductors

IC1.....	LM7812
IC2.....	LM7912
D1, 2, 3, 4.....	1N5404
D5, 6, 7, 8, 9.....	1N4004
LED1, 2, 3.....	5 mm red LED

### Miscellaneous

T1.....	30 V CT, 1 A sec (Arista type A-6672 or similar)
SW1, 2.....	DPDT toggle
F1.....	500 mA 2AG fuse

Fuse holder; 185x70x160 mm metal cabinet (DS-H-2744 or similar); mains flex and plug; mains clamping grommet; 3 x 5 mm LED mounting grommets; ETI-251 pc board; Scotchcal front panel; 70 mm length of 1 inch aluminium angle; 2 x TO220 mounting kits (mica washer, insulating washer and nuts and bolts); 3 x 4 mm banana socket binding posts (red, black and green); 35 mm length of radial fin heatsink; heavy duty hookup wire; 4 x 6 mm stand-off pc board spacers; 4 x pc board mounting nuts and bolts; 4 x 15 mm 4BA nuts and bolts; 2 x solder lugs; silicon thermal grease.

**Price estimate: \$45-\$50**

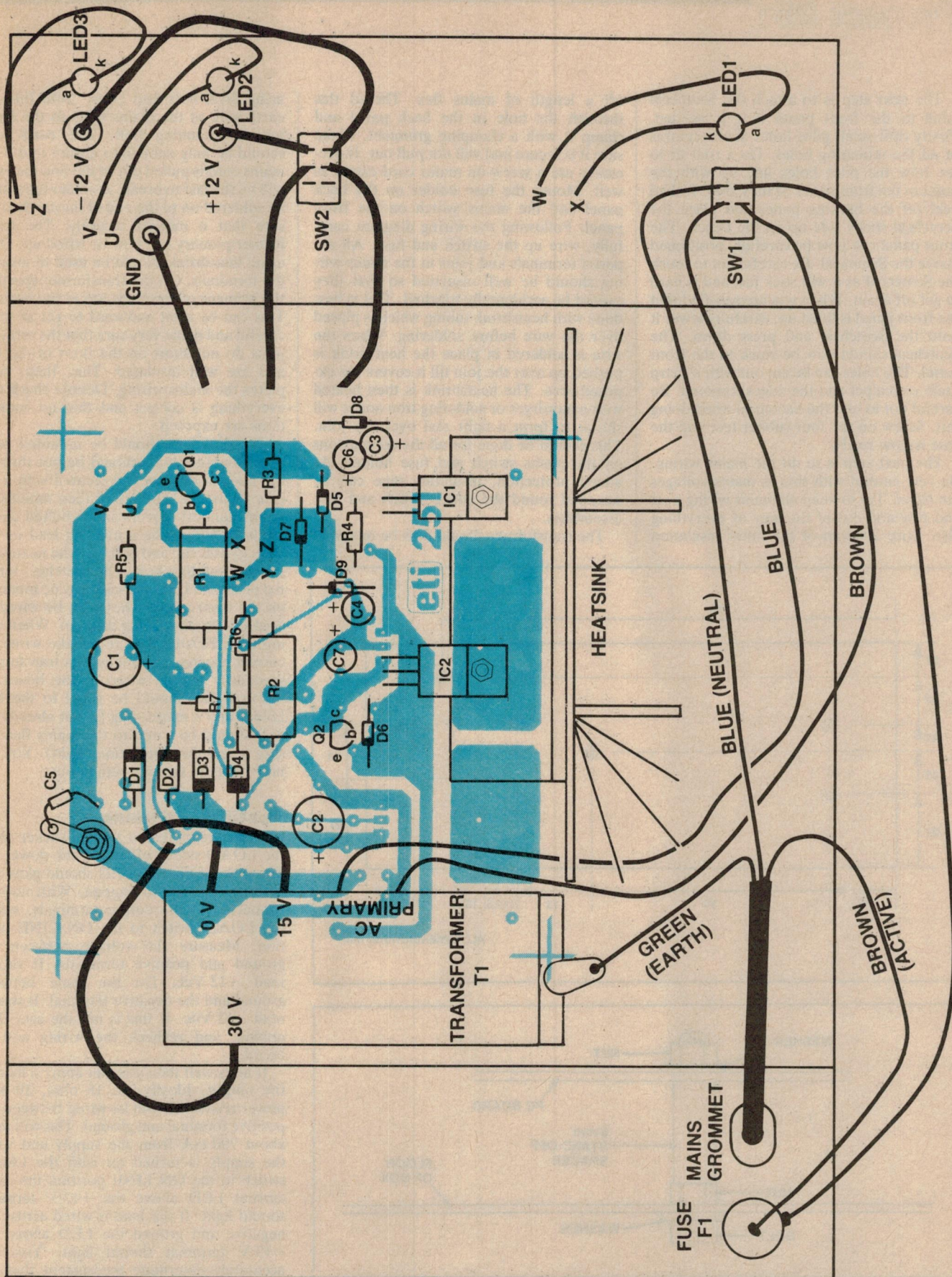
tive silicon grease. This will ensure good contact from the IC to the bracket. Put the mica washer in place over one of the mounting holes on the bracket and position the hole in the IC over the mounting hole. The bolt and washers can then be put through the hole and tightened up. Note that the bolt is isolated from the metal tab on the IC by a PVC insulating washer specially made for the TO220 package. Repeat the procedure for the other regulator.

To test whether the regulators are isolated from the heatsink, measure the resistance from the centre leg of one IC to the center leg of the other with a multimeter. You should get a high resistance (open circuit) reading. If not then take the ICs off and try again with fresh mica washers. After the ICs have been mounted correctly you can solder the legs to the pc board. The heatsink can now be mounted to the bracket. Use silicon grease to ensure good contact and screw the bolts up fairly tightly.

The next step is to solder flying leads to the input, output and LED mounting points on the pc board. These should be colour coded so you can easily identify the positive, negative or ground when you come to wire the LEDs or terminals. Light hookup wire is adequate for the LEDs but heavier wire (5 amp or more) should be used on the ac input and dc output points. If the pc board is placed temporarily in position in the case, you can get an idea of the length of

wire needed. Always allow a bit more length than you think you'll need as the wire can be trimmed later. Once all the wires are attached the pc board is completed and you can turn your attention to preparing the case.

The prototype was housed in an inexpensive aluminium instrument case (see parts list for details). Take the case apart and don't lose the screws. If you examine the photographs you can get an idea of the general layout of the inside of the case. Looking from the front, the pc board is mounted on the right-hand side at the front. The transformer mounts directly behind this. The mains cord and wiring is all on the left-hand side. Position the transformer and pc board in the box and, after you have ensured that there will be no possible shorting between transformer and the case or the transformer and pc board, mark the positions of the mounting holes for the transformer and board, and drill the holes to fit a 6BA bolt. Holes for the mains cord grommet and the fuse should be marked and drilled in the back panel. If necessary, drill a hole in the floor of the box for a mains cord clamp. To mark out the front panel you can either use the drilling diagram or you can use the front panel artwork as a template and centrepunch the holes from this. Drill the front panel holes to the appropriate sizes. Remove any burrs from the holes and smooth any rough edges.



## Project 251

The next step is to attach the Scotchcal label to the front panel if it is needed. Firstly drill small pilot holes at the centres of all the mounting holes. Do a trial fit to see how the pilot holes line up with the holes in the front panel. If they are OK then peel off the backing paper and place the Scotchcal sticky side up on the bench. The front panel can now be carefully positioned above the Scotchcal. Be careful not to touch the Scotchcal as it will stick fast and is hard to get off again. When you are satisfied that the front panel is lined up, carefully lower it onto the Scotchcal and press down. The Scotchcal should now be stuck to the front panel. The holes can be cut out with a sharp knife or scalpel and the edges trimmed. Be careful not to tear the Scotchcal when doing this. Screw on the four rubber feet and the case is now ready.

The next step is to do the mains wiring. Be *very* careful with this as mains voltages are *lethal*. Try to keep all mains wiring neat and tidy and out of the way of everything else. Strip 200 mm of the outer insulation

off a length of mains flex. Thread this through the hole in the back panel and clamp it with a clamping grommet. Make sure it is secure and will not pull out. If necessary use a screw-on mains cord clamp as well. Mount the fuse holder on the back panel and the mains switch on the front panel. Following the wiring diagram carefully, wire up the switch and fuse. All exposed terminals and joins in the mains wiring should be well insulated so that they cannot be accidentally touched. This is best done with heatshrink tubing which is placed over the wire before soldering. When the wire is soldered in place the heatshrink is pushed up over the join till it covers the exposed area. The heatshrink is then heated with a hairdryer or soldering iron and it will shrink to form a tight seal over the join. This should be done for all the connections on the mains switch and fuse holder. As added protection, insulating tape can be wrapped round the entire switch and fuse assemblies.

The transformer should now be mounted

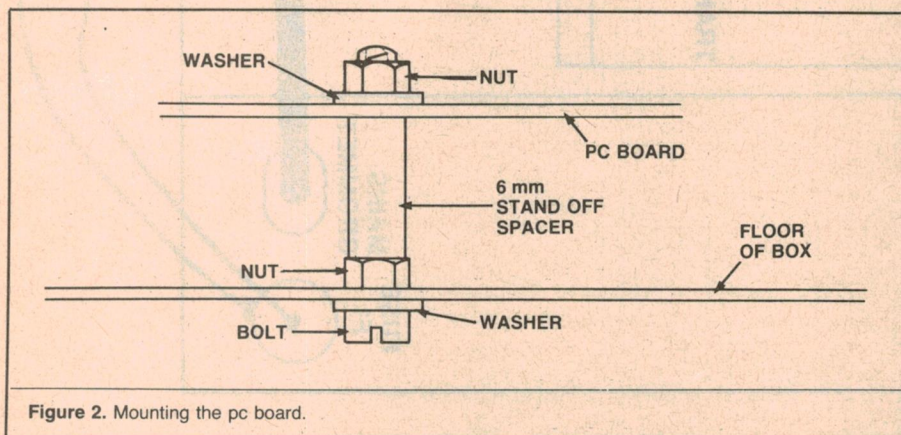
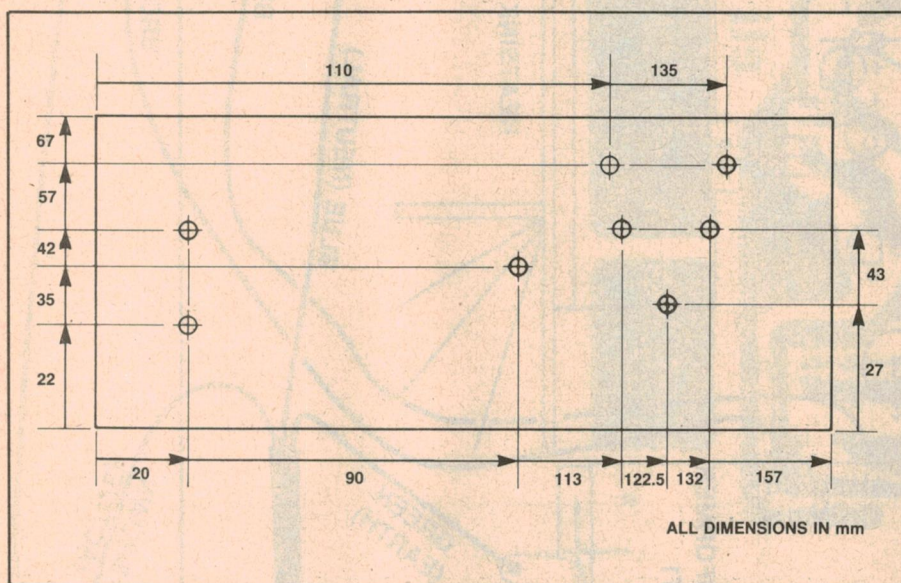
using 4BA nuts and bolts. Note that the earth wire of the mains bolts to the transformer mounting bolt. The earth wire should be long enough to ensure that if the mains cord is pulled out of the box the earth will be the last to break. A solder lug should be soldered on to the end of the earth to ensure that it mounts securely. The transformer primary can now be wired up. Once again heatshrink should be used to insulate the terminals. On the transformer specified the primary connections are at the bottom. This can be a bit awkward to get at so be careful and make very sure that the terminal joins do not short on the floor of the box and are well insulated. This, then, completes the mains wiring. Double check that everything is correct and that no connections are exposed.

The pc board should be mounted next. The mounting bolts should be put through the floor of the box and secured with a nut (see Figure 2). The board then mounts on 6 mm standoff spacers and is bolted down. Solder a lug on the remaining lead on the 100n bypass cap and bolt it to the nearest pc board mounting bolt. The switches, terminal posts and LEDs should now be mounted on the front panel. These can be wired up according to the wiring diagram. When wiring the LEDs be sure to get the wires the correct way round. Finally, the transformer secondary can be wired to the board. A 500 mA fuse should be fitted to the fuse holder and a mains plug (if not already fitted) should be wired to the mains flex (be sure to get the connections right). You are now ready to test the supply out.

### Testing and using it

Plug the supply into a mains socket. With the LOAD switch off switch the power on. The power indicator LED should glow and nothing else should happen. With nothing connected to the output terminals, switch the LOAD switch to the ON LINE position. Measure the voltage between the ground and positive terminals. It should read +12 Vdc. Do the same between ground and the negative terminal. It should read -12 Vdc. If this is not the case then unplug, and recheck the wiring and pc board.

If all is well then you can apply a load to the output. Ideally, an 18 ohm, 10 watt power resistor should be wired between the positive terminal and ground. This will draw about 700 mA from the supply and when the supply is turned on with the LOAD switch in the ON LINE position the over-current LED above the +12 V terminal should light. If the load is wired across the negative and ground the LED above the -12 V terminal should light. You can accurately determine the current that the LEDs switch at if you have a high power variable resistor or rheostat. This can be



**POWER**

+

+

**ON**

## ETI-251 OP-AMP POWER SUPPLY

$\pm 12\text{ V @ }1\text{ A TOTAL}$

**LOAD**

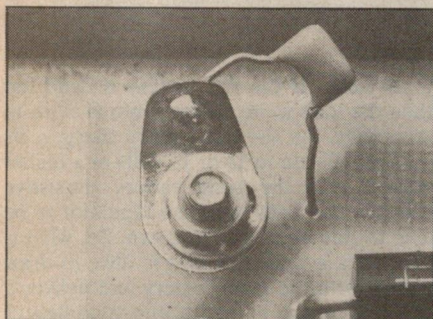
+

**ON  
LINE**

+ OVER CURRENT +  
+12 V -12 V

**GND**

+  
**COMMON**



A solder lug should be used to bolt the 100n bypass cap to the chassis. This allows the case to act as an rf shield but still provides for a floating supply.

varied until the LED just lights. The resistance can then be measured and the current determined.

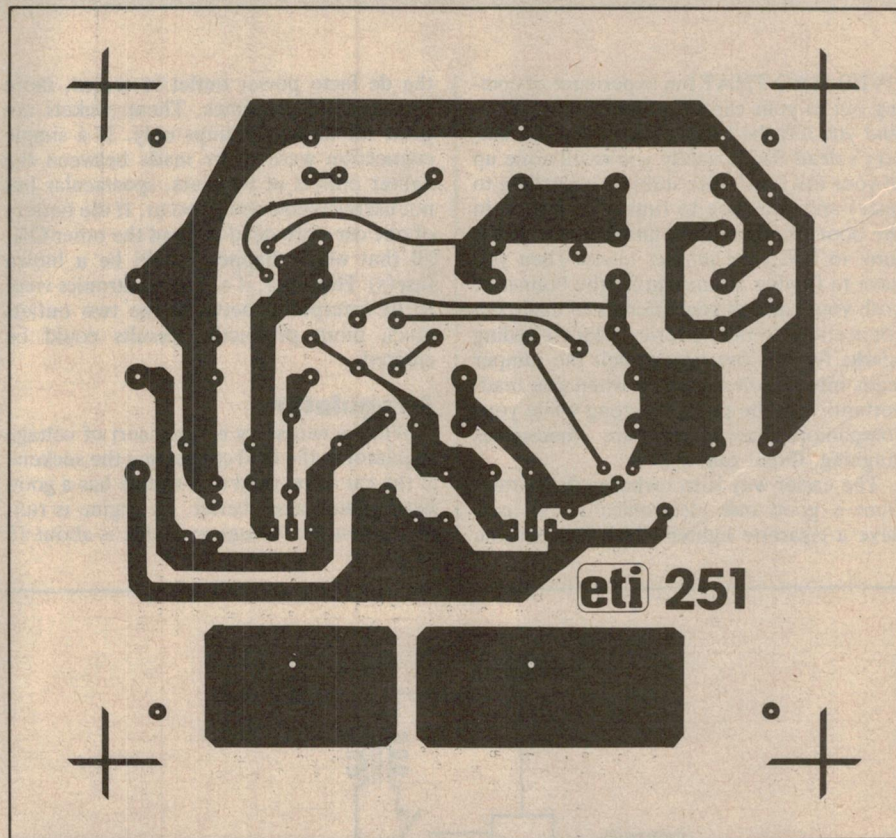
If the supply tests out OK so far, then connect a piece of heavy duty hookup wire between the positive and ground, and switch on. The supply should power up with the +12 V overcurrent LED lit. Do the same for the negative terminal. Finally, do the same thing with a piece of wire between the positive and negative terminals. Both LEDs should light this time. If all is well then switch off, unplug and put the lid back on. You are now ready to use the supply.

The only thing on the front panel that may require a few words is the LOAD switch. This merely disconnects the output terminals from the supply. This was done so that on power up and power down the load can be disconnected from the supply and thus be unaffected by any transients when the regulators power up or down. This is particularly useful when making changes to a breadboard for instance. If the main

power switch were used to turn the supply off then you would have to wait a couple of seconds for the capacitors to discharge and the voltage to go to zero before altering the circuit. Using the LOAD switch, the circuit is instantly disconnected from the supply.

If you are powering a circuit and the

overload LED comes on you should switch off. Although the supply can maintain overloads for quite long periods it is wise not to run the supply continuously in this mode as thermal stressing of the components can occur which may eventually lead to failure.



# ELECTRONIC JUMPER LEADS

What a great idea, eh? . . . Don't get your hands dirty next time your car has a flat battery. Charge it electronically through the cigarette lighter!

Ian Thomas

EVER HAD THAT fun experience of coming out to your car after a great evening to find you left the headlights on and the battery's dead flat? Usually you're all done up in your tux (or dinner stubbies according to taste) and you have to rummage around in the boot among all that unspeakably grotty junk to find your jumper leads. Then you have to fumble around under the bonnet of both your car and your friend's to make the connections to the batteries. Many blinding sparks fly and you nearly melt the jumper leads into a molten puddle when you inadvertently get the polarity wrong while your companions nearly fracture themselves laughing. Great fun, isn't it.

The easier way is to recharge the battery from a good one electronically. All cars have a cigarette lighter which has become

the de facto power outlet in recent, more health conscious times. These sockets are good for about 10 amps only. If a simple connection were to be made between the lighter outlets of two cars, spectacular but not useful events would occur. If the battery of one car were dead flat and the other OK, all that would happen would be a blown fuse(s). However, if a little electronics were to be interposed between the two outlets much more productive results could be created.

## A regulator

What is necessary is some sort of voltage regulator in the lead connecting the sockets. If the car to be used as a source has a good battery and, even better, its engine is running, then the voltage available is about 13

to 14 volts. If the flat battery is dead flat then the load to be charged into is close to zero volts. As the flat battery charges, its voltage will rise to 15 or 16 volts or a higher voltage than the good battery. Resistive losses in the leads require a regulator to be able to step up as well as down. So, what is needed is a regulator that is able to draw power from the good battery and deliver a constant current to the flat one regardless of the output voltage.

Another problem that has to be borne in mind is the fact that quite considerable amounts of power have to be handled. In the case of our dead flat battery, let's consider what would happen if a simple series pass regulator were used. If a charging current of 10 amps were used then the power that the regulator would have to dissipate at the start of the charge would be  $13 \times 10$  or 130 watts. This sort of power makes heat-sinks very hot and also wastes an awful lot of power.

The only answer to the power dissipation problem would be some sort of switching regulator. A conventional voltage regulator works by acting as an electronic variable resistance between the source and load to keep the voltage of the load constant. A switching regulator works on an entirely different principle. Voltage control is achieved by switching the source on and off very rapidly to control the output voltage and filtering the output square wave to obtain a (reasonably) smooth output voltage. As the main power handling device is either on like a switch, and hence has no voltage drop across it, or off, and has no current flowing through it, then it doesn't have to dissipate

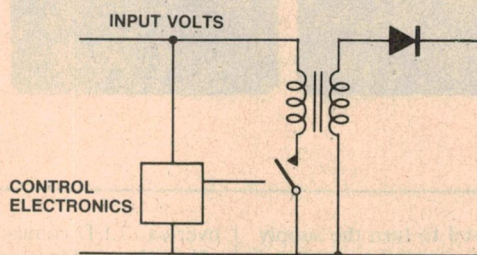
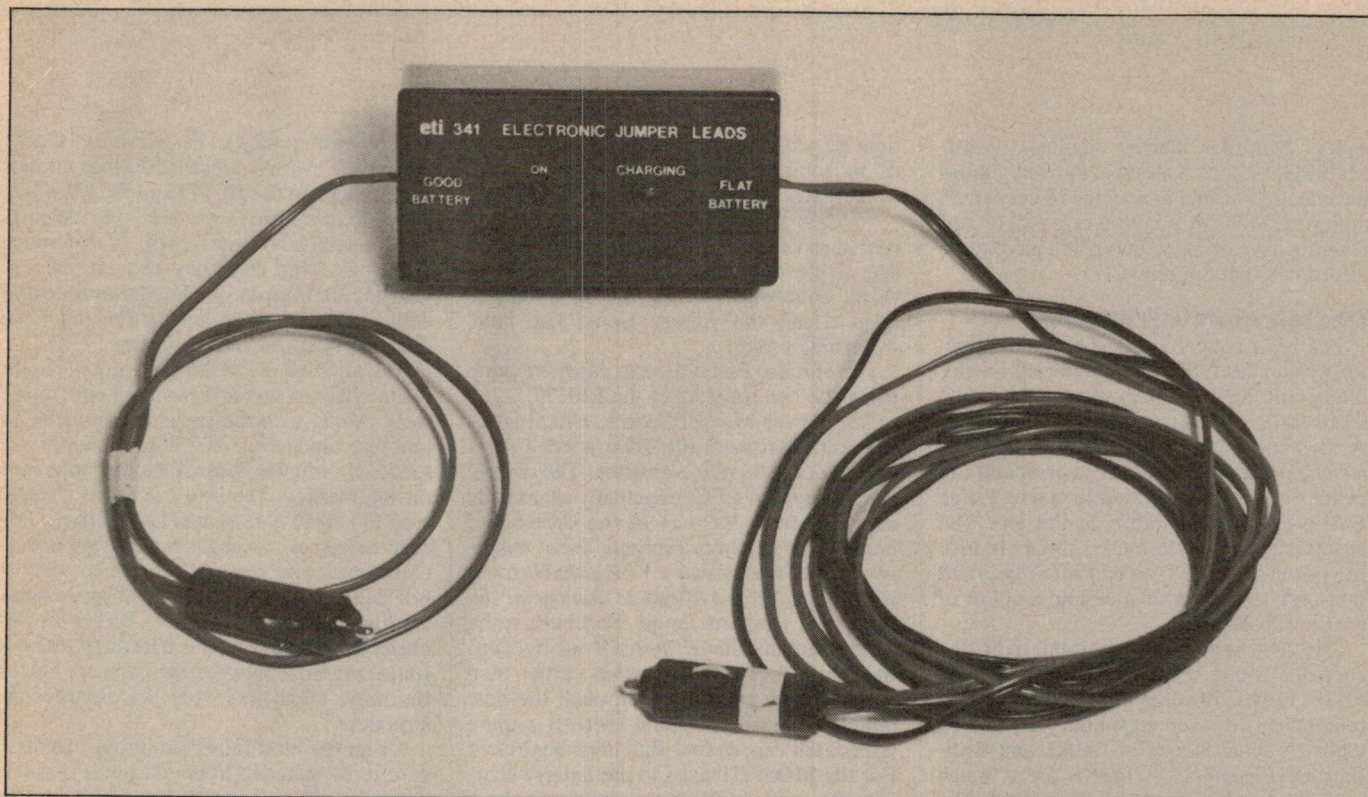


Figure 1. Simplified circuit.



much power.

This is all fine if the output voltage is less than the input voltage, but in our case the output must be either greater or less than the input. Fortunately, switching regulators come in many flavours and by using the filter inductor in various ways almost any desired characteristic can be obtained.

One of the most versatile forms of switching regulator is the flyback or ringing choke converter, which has no direct connection between the input source power and the output circuit apart from the main transformer/inductor. The converter operates by applying the source voltage to the inductor through the main switching transistor (see "How it works" section). This allows current to build up in the coil primary and hence stores energy in the inductor equal to  $\frac{1}{2}LI^2$ . When sufficient current has built up in the primary winding, the main transistor is switched off. One of the properties of an inductor is that it will not allow the current through it to change instantaneously. To do so requires infinitely large voltages. This is the exact dual of a capacitor where the voltage across a capacitor cannot be changed instantly — to do so requires infinite current (try shorting out a 10,000  $\mu\text{F}$  electrolytic and you'll see what I mean!). If the coil primary is switched off then the current flowing through it is immediately transferred to the secondary and, providing a current path is available to it, will flow there.

The handy part about this is that we're only interested in currents — the voltage across the primary and secondary doesn't matter. If the voltage across the secondary is high then the current will decay very

quickly and if the secondary voltage is low then the current takes a long time to decay, but power is transferred to the output circuit regardless of the output voltage. This type of circuit would seem to be ideal for the battery charger and is the one I used. In practice, the flyback converter is more critical in the design of the inductor than the more conventional down converter but its versatility often makes the design worthwhile.

### Controlling the current

Some quick sums showed that if reasonable charging currents were to be achieved a few tricks were going to be needed if the charger was to be small. The basic problem with the flyback converter is that all the power must first be stored in the inductor before it can be transferred to the output. This makes for a big lumpy inductor. To minimize this, the first trick is to never allow the coil current to decay to zero but turn the transistor on again after only part of the coil energy has been removed. This helps because the energy stored in the coil is proportional to the current squared, but the current rises in the coil linearly with time. Suppose we had a monster coil with a one henry inductance and applied one volt across it for one second. After the second, half a joule of energy would be stored in it. If the current were allowed to run up for another second then 2 amps would be flowing *and the energy stored would be 2 joules*. In other words, three times as much energy is stored in the inductor during the second second as was stored during the first. Clearly it's smarter to delete the first second alto-

gether. This is quite easy to do as all that's needed is to sense the secondary current and turn the main switching transistor on again after it drops to a preset level.

The next trick is to use an inductance of only a very few microhenries. This is fine (and obvious) and makes for a small inductor physically, but it means that when the input voltage is switched across the coil its current rises very fast and hence the main switching transistor on time becomes very short if the primary current isn't to become excessive. It has been implicit in all that I've said so far that the transistor can be switched on and off instantly. Sad to say but it can't. An average power transistor takes about a microsecond (less for fancy ones — maybe 0.2 to 0.3 microseconds) and when the switching transistor is neither on nor off it has volts across it and current flowing through. This means that when the transistor is switching it has to dissipate power. If you try to switch it on and off too fast then it spends most of its life halfway and gets very hot!

Fortunately, in recent years a new breed of transistor has appeared on the market called the power MOSFET. These devices have the wonderful property that they switch very, very fast. Instead of taking a microsecond to switch they can, with correct drive, switch in about 50 nanoseconds or so, allowing much smaller inductors to be used while still getting good converter efficiency.

If the main switching transistor is blindly fast then the output diode in the coil secondary must be fast to match. Once again devices are available, in this case

called Schottky barrier diodes. Power MOSFETs and Schottky barrier diodes have made a whole new range of very small and very efficient converters possible and recently have dropped enough in price to be affordable by the hobbyist.

## Design considerations

The basic converter consists of an inductor, power MOSFET and Schottky barrier diode but unfortunately there has to be some control circuitry to make them work. A variety of special integrated circuits are available to do this but they're pricy and can be hard to get, so I decided to make ye olde LM339 quad comparator do the job. The basic task to be performed is simply to turn the power MOSFET on and off at the right times but this requires a certain amount of decision making.

The first and most important thing the control circuitry must do is ensure that the FET is turned off when the coil primary current reaches its set maximum value. This tends to avoid clouds of smoke and such. Because the supply voltage is pretty much constant for this application, I decided to sense the actual voltage across the FET to determine the right turn off time. Power FET characteristics are fairly tightly controlled (that's part of what you pay the dollars for) so for a given control voltage it's fairly certain that for a given drain-source voltage the required current is flowing. Normally a sense resistor would be inserted between the source of the FET and ground to sense FET current, but this has undesirable side effects such as unwanted inductance which degrades switching time.

Another decision is when to turn the FET on again. In this case a sense resistor is necessary. It must be in the output winding circuit and must not cause excessive power loss. As peak current in the secondary (and primary) is about 15 amps, the maximum resistance is of the order of tens of milliohms before the resistor starts to get hot. It is not easy to make a resistor this small and you can't buy one off the shelf. I simply used a short length of copper wire of the

right size carefully twisted so as to minimize its inductance (see "Construction"). The actual value finally used was 13 milliohms.

The last control function to be performed is to keep the FET off when the output voltage of the converter rises above about 17 volts. Otherwise, if the output were left open circuit the voltage would rise until something broke.

All of these functions can easily be done using the comparators in the LM339.

The power MOSFET drive circuit is totally different from the drive needed for a conventional bipolar transistor. The control or gate input of a FET is actually electrically insulated from the rest of the device and hence has an almost infinite input resistance. *This insulation is a VERY thin layer of silicon dioxide and is easy to damage or destroy with static discharge.* You have to be careful not to charge yourself up by shuffling your feet across a nylon carpet then touching the gate lead. Although the gate input resistance is infinite there is a quite large input capacitance that must be driven. For the MOSFET used in the battery charger the capacitance amounts to about 1.2 nF but this is magnified during switching by miller capacitance from the drain to gate. To turn the FET on, the gate must be taken positive with respect to the source and the basic principle is the more positive the better (up to the maximum  $V_{gs}$  of 20 volts). Above about 12 volts the on resistance of the FET is 0.12 ohms and if the gate is taken to +20 volts this can be reduced to about 0.1 ohms. Since the dc supply voltage is 13.6 volts it doesn't seem worthwhile going to the trouble of generating an extra high voltage just to gain the extra little bit of efficiency.

The actual drive that needs to be applied to the gate is a square wave generated by the control circuitry, which needs to deliver almost no steady bias current but *must* be able to give very high current spikes during switching to charge and discharge the gate capacitance. The total gate power needed is very low so small T092 plastic transistors can be used but they must be able to pro-

vide at least an amp of current into the gate during the switch. Ideal transistors for this application are the BC327 and BC337 which are complementary npn and pnp devices. The easiest way to use them is as emitter followers. This way they provide current gain for the output of the comparator and deliver the current spikes on demand without any transistor bias problems.

The heart of the battery charger is the inductor (we all just love winding coils don't we!). Along with the range of power FETs and fast diodes for switching regulators, a range of inductor assemblies has appeared on the market. The one I chose is a TDK type PQ 20/16 core using H7C1 ferrite. The core comes as a complete assembly with a coil former and retaining clip. The core itself consists of two halves that are assembled around the coil former. To get the required coil inductance it's necessary to use a spacer material between the two core halves but more about this when we discuss construction.

By far the most important property of the core to be included in the design is that the primary and secondary windings must be tightly coupled together. If the two windings are simply wound one on top of the other on the former, the coil will show an excessive leakage inductance. This means that part of the energy stored in the coil primary will not be transferred to the secondary and must be dissipated by the power FET. To ensure the tightest possible coupling the primary and secondary windings are actually twisted together and then both wound on the core as one.

As the converter is switching at quite high frequencies (about 80 kHz) yet another parasitic effect must be allowed for in the coil. It's been known for a long time that if ac current is required to flow along a piece of wire then it tends to flow only along the outer surface of the wire. This is called the skin effect and has the effect of increasing the resistance of a piece of wire (ie a coil winding) and the higher the frequency of the current the higher the resistance. For copper it works out that for 100 kHz a 0.5 mm diameter wire has its resistance increased by about 12% so this seems to be the thickest wire that can be used if all the copper is to do work. In order to make up the total winding, many strands of 0.5 mm wire are twisted together then wound into the coil. To make the twisted wire strands lie neatly together I used seven lengths of wire in a neat hexagonal arrangement. This wasn't as hard as it sounds and resulted in a very neat inductor (it worked well too!).

One last remark must be made about the electrolytic filter capacitors on both the input and output sides. The converter is switching high currents and, because of the long leads into and out of the converter, most of the ac component of this current must be carried by the filter electrolytics.

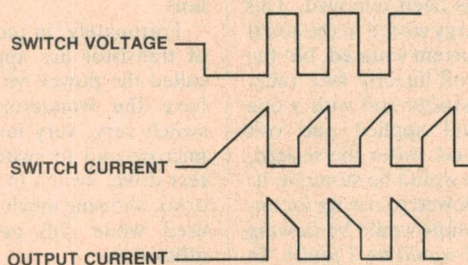


Figure 2. Circuit waveforms.

Fortunately the converter doesn't have to run reliably for 10,000 hours (you don't flatten your battery *that* often do you?), but if the electrolytics don't have a sufficient low impedance it may upset the operation of the converter. A good range of electrolytics is San-hwa. In the prototype I used Rifa capacitors. As a test in the prototype I purchased some samples from a certain aeronautically oriented gentleman's establishment which were brand named REC. The capacitors were beaut and small but their series resistance was far too high for switching regulators and they didn't work!

## Construction

By far the trickiest part of the project is the winding and testing of the coil so let's get that one over with first. The winding consists of  $10\frac{1}{2}$  turns of seven strands of 0.5 mm wire twisted together. If you look closely at the photo (right) you'll see that the strands are twisted together to make a neat cable. The total length of this cable needs to be about 600 mm long so to be sure you need to cut seven lengths of wire about 700 mm long. To twist them together you'll need an eggbeater drill or variable speed electric drill and a small piece of Vero board with holes drilled in it on 0.1 inch centres. Feed all seven wires through holes in the piece of Vero board as shown in Figure 3. Notice that they form a neat hexagonal pattern with the seventh wire in the centre. Twist all seven wires together tightly at one end for about 10 mm and place the twisted end in the chuck of the drill. Next make *absolutely sure* that all the wires are free and untangled and have no kinks in them. Stretch all the wires out straight and even, and clamp their free end in a bench vice.

Now comes the fun bit. Pull all the wires tight with the drill chuck and rotate the chuck slowly so the wires twist together. Have a helper hold the piece of Vero board so it's about 15 mm from where all the wires are lying together and move the Vero board along the wires as they twist up to maintain the constant 15 mm spacing. This should result in a beautiful neat cable being formed. The centre wire will become loose as the other wires are wrapped around it, though this didn't give me any trouble. The end result of this exercise should be about 650 mm of wire ready to be wound onto the former.

The first step is to trim about 20 mm off the end of the wire, which is probably a bit ratty, and then spread out 15 mm of the end of the cable. Tin about 5 mm of the end of *four* of the seven wires. You'll see that the coil former has two groups of four pins on one side and two groups of three on the other. Stand the former on its pins with the two groups of four facing you. The four tinned leads go onto the pins on the *right*. This is the start of the primary and is connected to the drain of the MOSFET on the circuit board. Check what you're doing

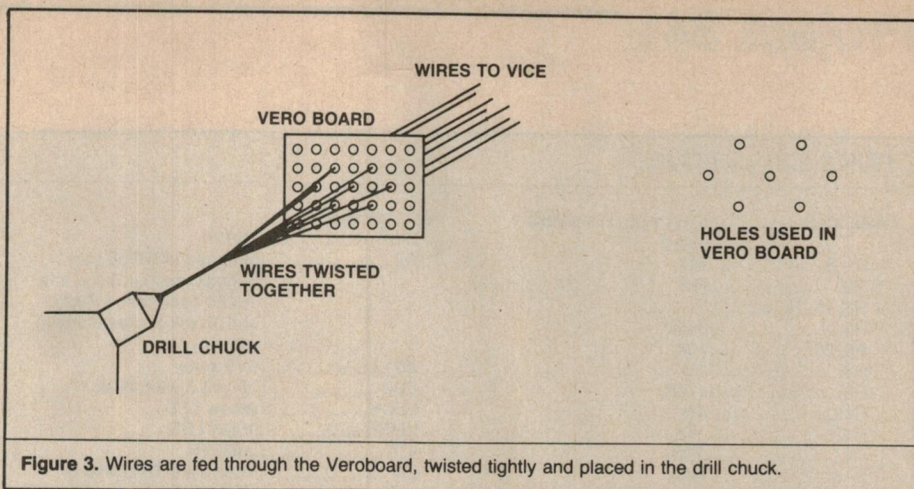
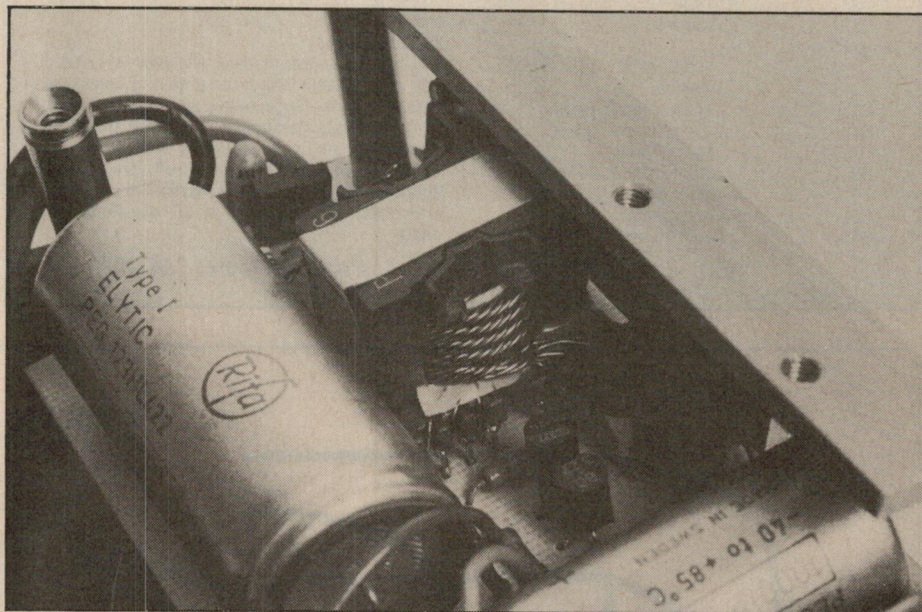


Figure 3. Wires are fed through the Vero board, twisted tightly and placed in the drill chuck.



Close up view of mounted coil.

against the board layout to make sure you've got it right. The last three wires are tinned about 15 mm in from the first four and are the start of the secondary. If you look at the top of the former with the pins facing away from you the coil is wound *anti-clockwise* so you'll wind on about a quarter turn of the four strand primary before the three strand secondary joins the cable. The start of the secondary is connected to the power diode so once again you can check that you're doing it right by comparing the coil former to the board layout.

The next bit is easy. Wind the cable around the former until you've got one full layer. This should take about five to five and a half turns. Then wind on a second layer to give the full 10 turns. Finish the winding next to the unused three pin group *but don't cut off the wires*. Untwist the cable for about 40 mm from where the winding ends next to the three unused pins and tin the ends of all seven wires. This is so you can check for continuity and find which wire

should connect where. Using a multimeter on the ohms setting, test for continuity between the group of three pins and the end of the wires. Terminate the end of the secondary three wires on the unused three pins then wind the other four wires another quarter turn and terminate them on the unused group of four pins. You should now have a complete wound coil with all wires terminated.

As a last check take four pieces of tinned wire (resistor leads that have been cut off are fine) and tack together the four wire start of the primary, the four wire end of the primary, the three wire start of the secondary and the three wire end of the secondary. Now check that there is no continuity between the primary and secondary windings. If there is, you've made a mistake and will have to disconnect the end of both the primary and secondary and try again.

Next you must assemble the ferrite cores around the coil. As previously mentioned, the cores must be spaced slightly apart to

## PARTS LIST — ETI-341

**Resistors**.....all 1/4 watt, 5% unless noted

R1, 6, 7, 11 .....2k7  
R2 .....4k3  
R3, 15, 18 .....1k  
R4 .....330k  
R5, 20 .....10k  
R8 .....1M  
R9 .....470R  
R10 .....47k  
R12 .....2k2  
R13 .....680R  
R14, 17 .....120k  
R16 .....56k  
R19 .....15k  
R21 .....100R  
R22 .....see text

### Capacitors

C1, 2 .....1000 $\mu$  (1mF) 16 V A1 electro  
C3, 6 .....100p ceramic plate  
C4, 5 .....470p ceramic plate  
C7, 11 .....1n met poly  
C8 .....2200 $\mu$  (2m2) 25 V A1 electro  
C9 .....100n ceramic monolithic  
C10 .....4 $\mu$ 7 35 volt tag tant

### Semiconductors

D1, 3, 4 .....1N914  
D2 .....Motorola MBR735 (any Schottky barrier diode in a T0220 pack with a 7 amp and 35 volt or greater rating will do)  
ZD1 .....6V8 zener  
ZD2 .....75 volt 1 watt zener  
LED1 .....yellow LED  
LED2 .....green LED  
IC1 .....LM339N  
Q1 .....Motorola MTP12N10 or MTP12N08  
Q2 .....BC327  
Q3 .....BC337

### Inductors

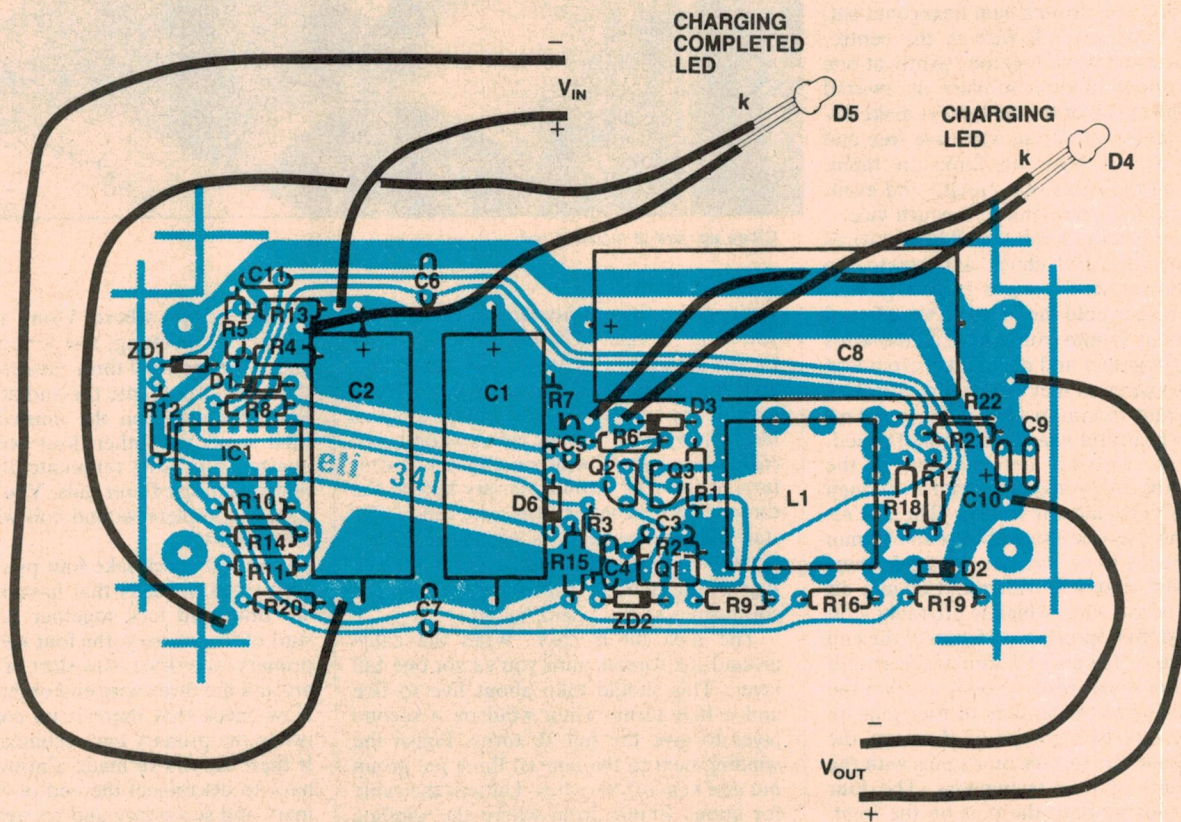
### Miscellaneous

ETI-341 pc board; medium jiffy box (41 x 68 x 130 mm); 35 mm length radial fin heatsink; 2 car cigarette lighter plugs; heavy duty speaker cable; LED mounting grommets; 2 x T220 mounting washers, nuts and insulating washers; 4 x 25 mm tapped pc board stand-off spacers and screws; 2 small self-tapping screws or 6BA nuts and bolts; 75 mm length of 25 mm aluminium angle.

Price estimate: \$44.00

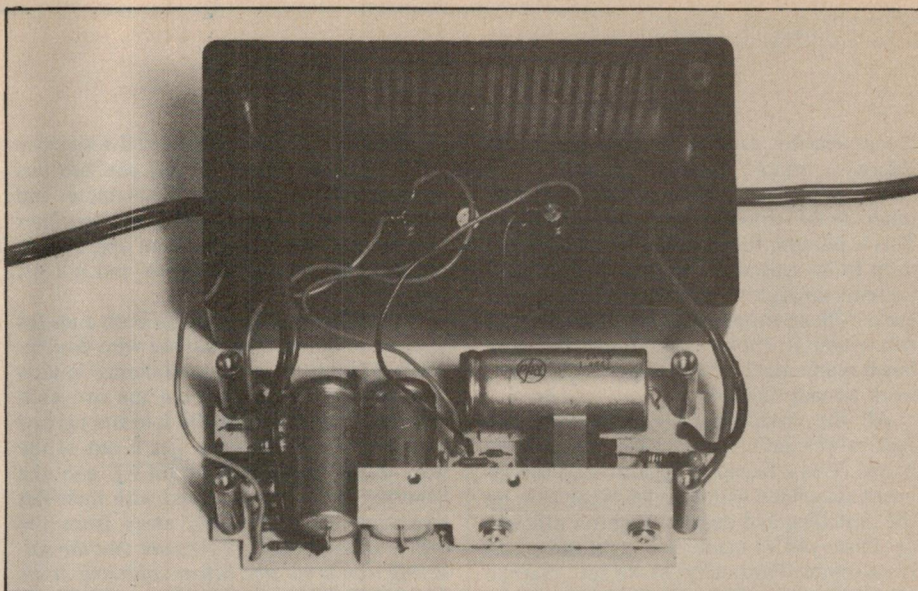
get an air gap. The gap needs to be about 0.6 mm to give the right inductance. Rum-mage around and find some suitable material, remembering that *you can't use metal*. As an example, the cardboard used in manila folders is about 0.25 mm thick so a couple of thicknesses of this would be OK or you may choose to find something else. A vernier caliper or micrometer is a great help here! Cut the material out to the same shape as the two mating faces of the cores and assemble them with the spacer material in place. Clip the cores together using the mounting clip provided and the core's ready for testing.

To test the coil leave the four wires you've tacked on to test continuity in place and add a 1k resistor in series with one side of the primary. Tack a 1 microfarad capacitor in parallel with the winding. Beg, borrow or whatever an audio oscillator and connect the output to the oscillator to the 1k resistor. The earth end of the oscillator goes to the other end of the primary. Now monitor the voltage across the coil with an oscilloscope or wide band ac voltmeter. You should find a nice sharp resonance at

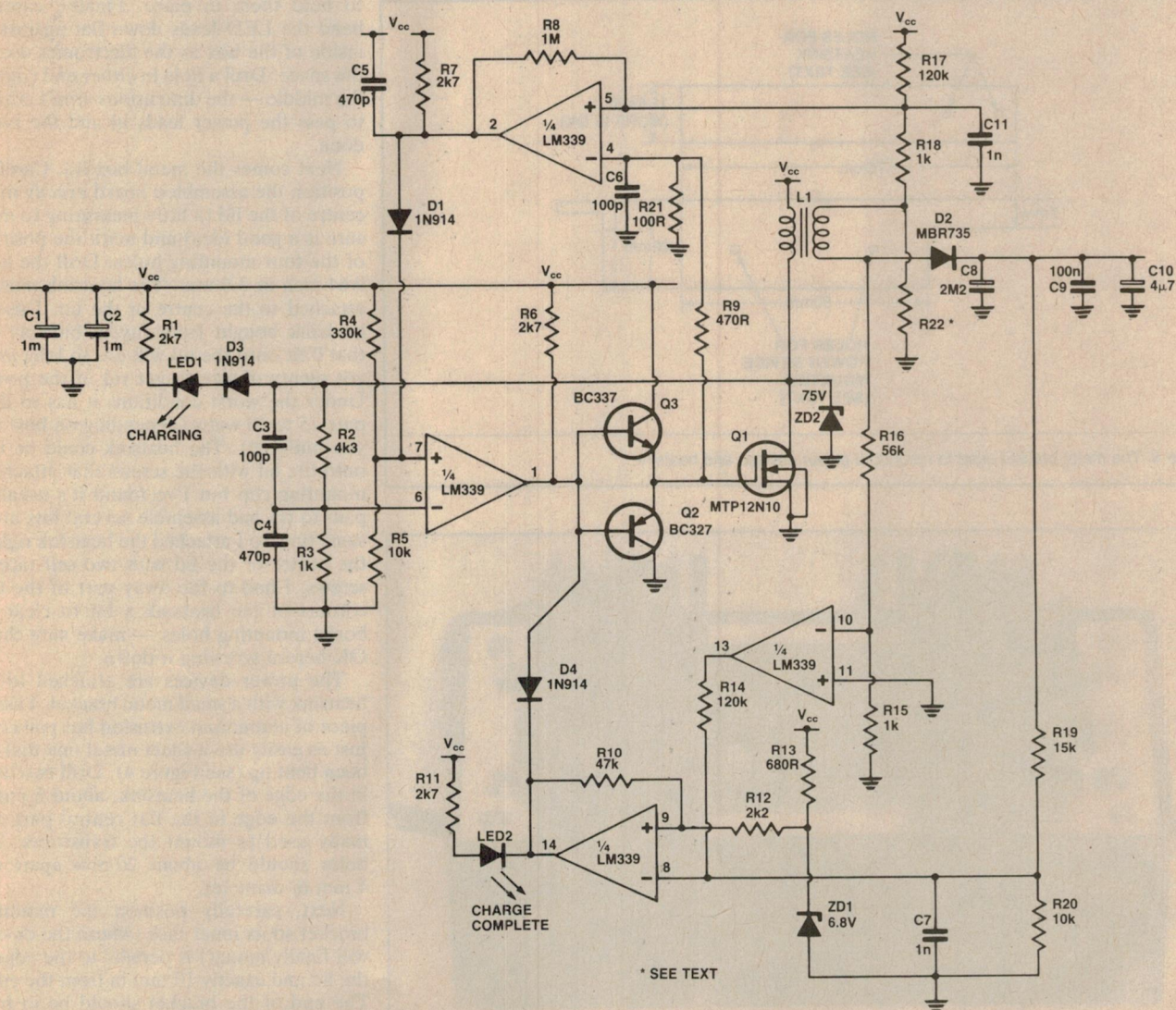


around 50 kHz. Anywhere between 30 kHz and 70 kHz is fine — the current sensing in the electronics will look after any discrepancies. To a large extent this test is optional provided the spacer is the right thickness; the electronics will look after any minor differences. That's the hard bit done.

The charger was built into a plastic box with a metal base bought from Dick Smith Electronics. I wanted it to be as small as possible so, after working out the component area needed, I opted for the 130 x 67 x 41 mm size (they seem to have about 800 different sizes!). If you're making your own artwork watch out for the board dimensions as the components use all the available space. There are also a few tricks used in the board layout to avoid unwanted effects so, all in all, it's probably better to use the



The assembled board is positioned exactly in the middle of the box lid.



layout exactly as it is. For example, the reference 'ground' for both inputs for pins 4 and 5 of the comparator are next to each other (ie the ground ends of R21 and R22). This is because there is only a small voltage drop to be sensed across R22 and the high currents through the inverter can easily generate voltage drops along earth tracks that will swamp it. Probably the safest way is to buy a ready-made board or get the ETI artwork already checked.

All the components including the two high power devices mount directly onto the board. This is because the stray lead inductances associated with long leads can slow up the switching and degrade inverter efficiency. Once you've made or bought the board it's assembled normally. Make sure that the electrolytic capacitor and diodes go in the right way. R22 is not actually a resistor but a piece of copper wire 0.36 mm in diameter

(27 AWG). To get the required resistance you'll need 80 mm of wire if you use this diameter but you can vary the diameter and vary the length to suit. Don't use too finer and shorter wire though, as an appreciable amount of power is dissipated and it'll get hot.

To mount the wire, first tin both ends for about 2 or 3 mm then fold the wire double. Twist it together tightly to minimize inductance effects then spread out the two ends and solder them in. Finally fold the twisted wire to make it neat and get it out of the way. Both the power MOSFET and the Schottky diode are mounted with their flat mounting surfaces facing away from the centre of the board. *Make sure that the soldering iron is earthed before soldering in the MOSFET.* If it isn't, there is a good chance you'll damage the gate insulation when you solder the gate lead — and the MOSFET is

the most expensive device on the board! When both power devices are correctly placed their mounting surfaces should be in the same plane ready for attachment to the heatsink mounting bracket.

To prepare the box ready for the board drill two 1/4-inch holes for the indicator LEDs and insert the plastic mounting clips. Cut four pieces of lead wire about 100 mm long (preferably of different colours so you don't have to peer into the box all the time to figure out which is which) and bare and twist the ends for about 5 mm. For the two LEDs the longer lead *must* be connected to the positive. Carefully clip off the *shorter* (cathode) leads about 7 mm from the base and solder your chosen coloured leads to them. Make life easy for yourself by writing down on a piece of paper what connects to what then repeat the process for the two anode leads. Insert the LEDs into the clips and push the mounting rings over the clips to hold them in place. Finally, carefully bend the LED leads down flat against the inside of the box as the electronics uses all the space. Drill a hole in either end (right in the middle — the dimensions aren't critical) to pass the power leads in and the box is done.

Next comes the metal box lid. Carefully position the assembled board *exactly* in the centre of the lid (a little measuring to make sure is a good idea) and mark the positions of the four mounting holes. Drill the holes 9/64 inch or 3.6 mm. The heatsink must be attached to the centre of the lid. I used a heatsink bought from Jaycar but any one that'll fit onto the lid will do, so long as it's got plenty of size to get rid of the power. Under the worst conditions it has to dissipate 15 to 20 watts (depending on how well you build it!). The heatsink could be held onto the lid with the screws that attach the mounting clip but I've found it's usually a pain to try and assemble several bits at the same time so I attached the heatsink right in the centre of the lid with two self tapping screws. I had to file away part of the four corners of the heatsink a bit to clear the board mounting holes — make sure this is OK before screwing it down.

The power devices are attached to the heatsink with a small metal bracket. I used a piece of aluminium extrusion but you could just as easily use a sheet metal one that has been bent up (see Figure 4). Drill two holes in the edge of the heatsink, about 5 mm in from the edge in the flat central part normally used to mount the transistors. The holes should be about 20 mm apart and 4 mm in diameter.

Next, carefully position the mounting bracket so its inner face (where the devices will finally mount) is parallel to the edge of the lid and exactly 10 mm in from the edge. The end of the bracket should be in from the end of the lid by about 13 mm but it's

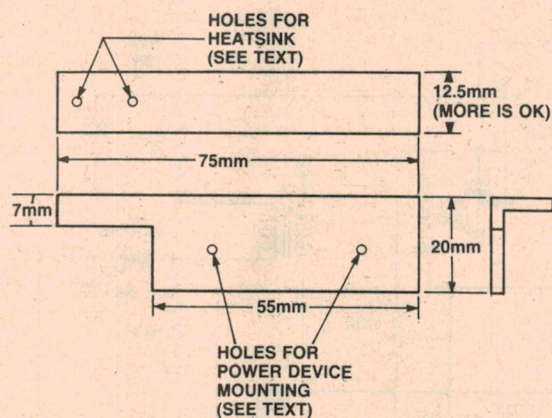
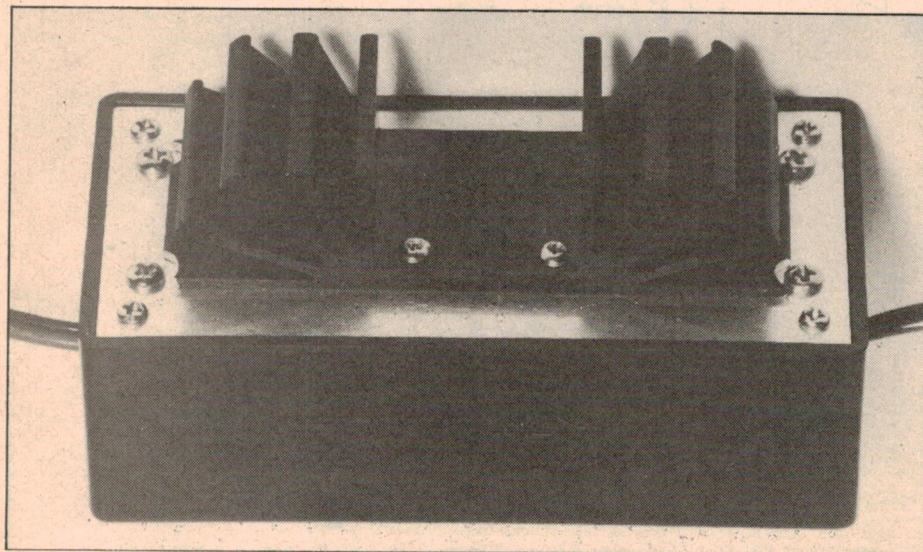


Figure 4. The metal bracket used to mount the power devices and heatsink.



best to hold the board up to the assembly you're marking to see what you're doing.

Finally, drill the two holes you've marked out. In the prototype I actually tapped threads in these two holes but self-tapping screws would work as well so long as they are big. As this bracket must conduct waste heat to the heatsink it *must* be clamped good and tight. Also, nuts and bolts can't be used as the nuts would be a bit hard to get at.

The board is mounted on the lid with four 1-inch tapped metal spacers. Attach the spacers to the board and the board to the lid. The heatsink bracket should lie nicely against the power device mounting surfaces. Mark where the holes in the power devices lie on the bracket (it's a bit awkward but I did it OK) then take the board off the lid and the bracket off the heatsink. Drill the last two holes in the bracket to clear the insulating hardware that comes with the power devices and mount the bracket onto the power devices using all the insulating hardware. Connect up the power leads to the board and the cigarette lighter plugs to the other ends of the leads *making absolutely sure that the positive connects to the centre pin of the plugs*. The input lead should only be a metre or so long but the output can be as long as you like. Finally, using the piece of paper you've kept, connect up the four leads from the LEDs in the lid to the board and it's ready for testing.

## Testing

Before turning anything on, double-check that the zener diode ZD2 is in and the right way round. If it's the wrong way round it will burst into flames and if it isn't in at all the MOSFET will have a hard time. Connect a voltmeter across the output and set it to 20 or 30 volts range. Finally, apply power to the input (if you're using a power supply watch the polarity!). There should be a current in-rush as the power is applied then the current should drop to about 20 mA. The output voltage should jump to about 17 volts. The 'charging' LED1 will not come on as the converter has only to maintain the charge on the output capacitor, but the 'charge completed' LED2 should light. Anything else means you've got trouble.

If the output voltage goes off scale then the regulation circuit isn't operating or D4 is in the wrong way. As a final check disconnect the voltmeter from the output and, if it has a 10 A range, set it to this then *briefly* connect it to the output. The meter should read about 6 amps and the 'charging' LED1 should come on. Also the 'charge completed' LED2 should go off. Don't leave the ammeter across the output for too long though, as the power devices aren't connected to the heatsink. If all is well you can screw the board onto the lid and the heatsink mounting bracket onto the heatsink.

The battery charger is a basic flyback or ringing choke converter using voltage sensing across the main switching transistor to determine peak coil and current sensing in the coil secondary to set coil minimum current. Switching is done using a power MOSFET so the converter can operate at high frequency and an LM339 quad comparator is used to perform all control functions.

The converter operates by switching on the main transistor Q1 and allowing current to flow through the primary of L1. Since the voltage across the coil is constant, the current through it will rise linearly with time. As a power MOSFET which is turned hard on behaves very much like a resistor, then with the rising current in the coil the voltage across Q1 also rises. As Q1 is on, its gate is held at about 13 volts by the output of the comparator IC1 pins 1, 6 and 7 through the driver transistors Q2 and Q3.

The positive voltage on the MOSFET gate means that the negative input of the comparator IC1 pins 2, 4 and 5 is also held positive through R9. This makes the output of this comparator, which is used to sense coil secondary current, negative and reverse bias (or at least not forward bias) D1. This leaves the negative input of the MOSFET drive comparator pins 7, 6 and 5 to be set by the potential divider R4 and R5. This situation remains stable as long as the coil current doesn't exceed its peak value.

As soon as the coil primary current reaches its maximum value, the voltage on the comparator pin 6 rises above that set on pin 5 and the comparator output changes state. This turns off Q1 and positive feedback through C3 and C4 ensures a fast and clean switch. The 12 to 15 amps that was flowing in the primary winding is immediately transferred to the secondary circuit and flows through D2 and R22. R22 is the secondary current sense resistor and the current flows in such a direction as to take the end of the coil and the end of R22 negative. As the power FET is off, its gate is at ground potential and hence pin 4 of the current sense comparator is also at ground. R17 and R18 couple the negative voltage from the current sense resistor to the positive input pin 5. As current runs down in the coil secondary the voltage across R22 decreases linearly until pin 5 of the current sense comparator starts to go positive.

At this time the output of the current sense comparator goes rapidly positive and forward biases D1. This takes the positive input of the FET drive comparator positive and hence the output of the comparator goes positive and turns the FET on again to repeat the cycle. Thus the current through the coil is switched between a maximum value set by the on state voltage drop across the power MOSFET and a minimum value (nominally half of the peak value) set by a sense resistor in the secondary circuit.

To monitor the converter output voltage a zener diode is used to generate a reference

voltage which is applied to a control comparator, IC1 pins 8, 9 and 14. As the reference is applied to the positive input of the comparator and some hysteresis is needed in the voltage control, R12 is in series with the input and R10 provides positive feedback around the comparator. A simple potential divider R19 and R20 transfers the output voltage and applies it to the negative input of the comparator. Thus if the output voltage of the converter rises above about 17 volts, pin 14 of IC1 goes negative and holds the gate drive to the MOSFET off.

One last problem remains to be solved which is that when current is flowing into the secondary circuit it momentarily raises the output because of the unwanted series resistance of the filter capacitor C8. This is a rather unknown property as the quality of the electrolytics will vary with the brand. Its effect is to raise the voltage on pin 8 during the current rundown and prevent the current control comparator from turning the FET on again until all the current had been transferred. This reduces the charge current out of the converter.

To avoid this, the fourth comparator in the IC is used to sense when current is flowing in the secondary circuit and disable the output voltage comparator pins 8, 9 and 14. When current is flowing in the secondary circuit the anode of the main diode D2 is positive and when the power FET is on it goes negative. Thus it's an easy business to translate this large voltage swing to suitable levels for the comparator input.

R15 and R16 ensure that the large diode voltage swings don't exceed the maximum input voltages. When current is flowing in the secondary, the output pin 13 goes to ground and pulls pin 8 of the output voltage comparator negative. This ensures that pin 14 remains positive during the secondary current cycle of the inverter and allows the power FET to be turned on again at the correct time. When the output in 14 is negative and holding the converter off it also passes current through the green LED2 to indicate that the output voltage has reached 17 volts and charging is completed.

Also, when the converter is running and current is flowing in the secondary circuit the drain of the MOSFET is above the positive rail. This turns on D3 and passes current through the yellow LED1 and R1 to indicate that the converter is running.

Zener diode ZD2 (75 volt) is placed between the drain of the FET and ground as there is always a small amount of energy that isn't coupled to the coil secondary winding. This energy is stored in what is called the transformer primary leakage inductance. Since the power MOSFET switches in a few tens of nanoseconds there is no time for the transistor to safely dissipate this energy and it will produce excessive voltage spikes on the primary and drain. ZD2 absorbs these spikes and prevents the FET from being damaged.

Finally, ease the whole works into the box and screw down the lid. The whole unit is then ready for use.

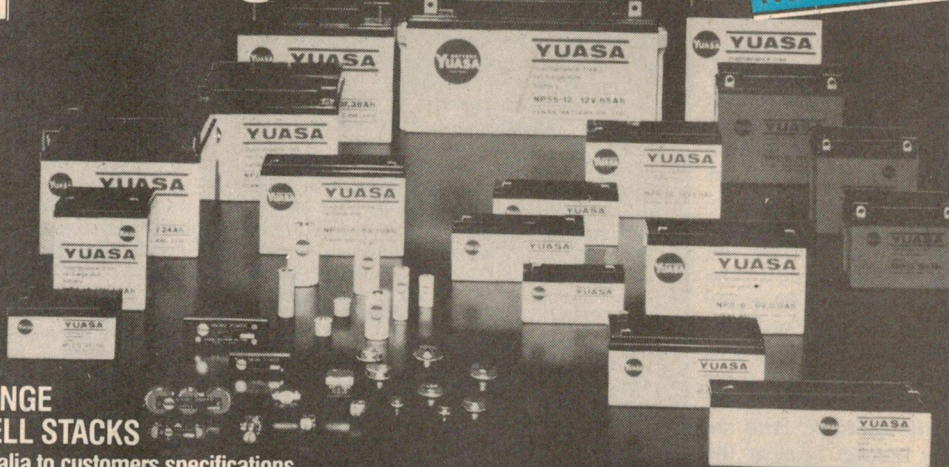
A final word of warning: if the charger is connected the wrong way round and attempts to draw charge off the flat battery, then that is exactly what it will do. Unless the flat battery is absolutely dead flat then

everything will appear to be just fine except that the flat battery will be sucked dry to charge the good one — a waste of time. Also, when you're using the unit, the higher the input voltage the quicker the battery will be charged so leave the engine idling while it's running unless you're not in a hurry.



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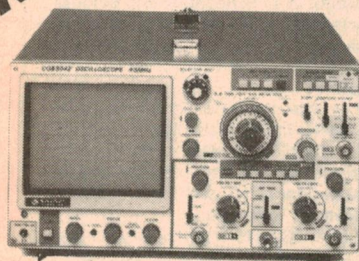


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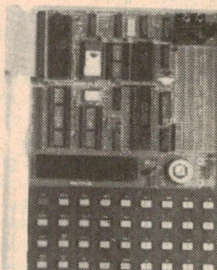
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AE 1005	Microcomp I.A 3 Chip Z80 Computer Kit A low cost introduction into microcomputer programming	55.75	AE 1017	8 Watt Amplifier	9.70
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AE 1007	TEC IB Computer Power Supply inc. transformer and case	44.25	AE 1019	Logic Designer	20.90
AE 1008	Combination Lock	7.50	AE 1020	Logic Probe	11.55
AE 1009	Counter Module	21.70	AE 1021	Logic Pulser	12.30
AE 1010	Seven Segment Display	11.40	AE 1022	Mini Frequency Counter	18.90
AE 1011	Cube Puzzle	17.90	AE 1023	Stereo Mini Mixer	23.10
			AE 1024	Square Wave Oscillator	4.70
			AE 1025	Stereo VU Meter	14.00
			AE 1026	Non Volatile Ram	23.20

All Active kits include full assembly instructions and the component layout is printed on each circuit board to simplify construction.

**MAIL ORDER HOTLINE**  
**(03) 67 1312**

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\$1-99.99 \$2.00  
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\$1000-1999.99 \$7.50  
\$2000 plus \$10.00

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Call in at either of our two conveniently located Stores:  
289 Latrobe St., Melbourne 3000. Ph. 602 3499 or  
887 Springvale Rd., Springvale 3171. Ph. 547 1046

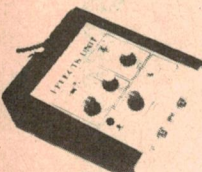
# Kits to suit everyone at



## EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system. (EA Oct. '84) 84MS10 Cat. K84101

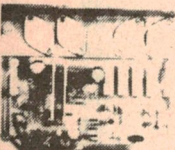
\$24.95



## EFFECTS UNIT

An "effects unit" that can create phasing, flanging, echo, reverb and vibrato effects. (EA June '83) 83GA6 Cat. K83060

\$75.00



## MOSFET POWER AMPLIFIER

Employing Hitachi Mosfets, this power amplifier features a 'no compromise' design, and is rated to deliver 150 W RMS maximum and features extremely low harmonic, transient and intermodulation distortion. (ETI Jan. '81) ETI 477 Cat. K44770

\$69.50



## 50 W AMPLIFIER MODULE

Cat. K44880 (\$27.50) (Heatsink optional extra)

## 100 W AMPLIFIER MODULE

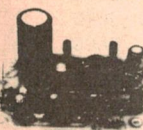
Cat. K44801 (\$29.95) (Heatsink optional extra)



## 150 W BASS AMP

This guitar amp for impeccable bass players features many facilities found on expensive 'commercial' ones. It delivers 150 watts into 4 ohms, has a t-band graphic limiter, line out and bi-amp facilities. (ETI Aug. '84) ETI 1410 Cat. K54100

\$299



## PARABOLIC MICROPHONE

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of components for this project is around \$15 including sales tax, but not the cost of batteries or headphones. (EA Nov. '83) 83MA11 Cat. K83110

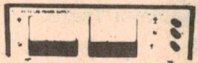
\$15.00



## 30 V/1 A FULLY PROTECTED POWER SUPPLY

The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both voltage and current metering is provided. (ETI Dec. '83) ETI 162 Cat. K41620

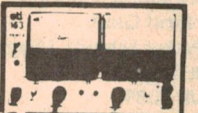
\$52.50



## 50V 5A LABORATORY POWER SUPPLY

New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design. (EA June '83) 83PS5 Cat. K83050

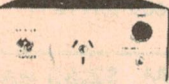
\$149



## LAB SUPPLY

Fully variable 0-40V current limited 0-5A supply with both voltage and current metering (two ranges: 0-0.5A/0-5A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by unique relay switching system switching between taps on the transformer secondary. (ETI May '83) ETI 163 Cat. K41630

\$175.00



## 40 W INVERTER

This 12 240 V inverter can be used to power up mains appliances rated up to 40 W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May '82) 82IV5 Cat. K82050

\$54.50



## ELECTRIC DUMMY LOAD

With this unit you can test power supplies at currents up to 15 Amps and voltage up to 60 Volts. It can "sink" up to 200 Watts on a static test and you can modulate the load to perform dynamic tests. (ETI Oct. '80) ETI 147 Cat. K41470

\$109



## ZENER TESTER

A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes. (ETI Aug. '83) ETI 164 Cat. K41640

\$9.50



## TEMP PROBE

Can measure temperature from -50 to 150°C. It simply plugs into your multimeter - great for digital multimeters. Accuracy of 0.1°C resolution of 0.1°C. (ETI June '83) ETI 153 Cat. K41530

\$24.50



## EPROM PROGRAMMER

If you have ever wanted to rewrite or extend the operating system of your microcomputer or if you're interested in dedicated microprocessor applications then this EPROM Programmer is just the thing. It is an inexpensive unit that uses readily available IC's, interfaces directly to the expansion bus on the back of all the popular 8080/286 microcomputers and programs 2708's, 2716's, 2758's and 2732's. (EA July '80) 80PP71 Cat. (Horwood case supplied)

\$79.50



## EPROM PROGRAMMER EP1

No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms. (EA Jan. '82) 82EP1 Cat. K82013

\$47.50

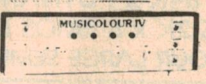
With Textool Socket \$59.95



## FUNCTION GENERATOR

This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160Hz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting. (EA April '82) 82AC3A/B Cat. K82040

\$87.50



## MUSICOLOR IV

Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety. (EA Aug. '81) 81MC8 Cat. K81080

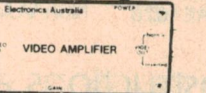
\$89.00



## VIDEO ENHANCER

100's SOLD Like tone controls in a hi-fi amplifier, touch up the signal with this Video Enhancer. (EA Oct. '83) 83VE10 Cat. K83100

\$35.00



## VIDEO AMPLIFIER

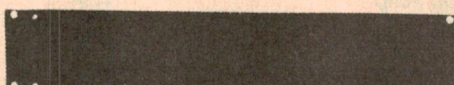
Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead. It's much better! The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugback supply. (EA Aug. '83) 83VA8 Cat. K83081

\$15.00

## SERIES 5000 PRICES SLASHED!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Super Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,000 Sold.

For those who haven't that time and want a quality hi-fi, we also sell the Series 5000 kits Assembled and Tested.



## POWER AMPLIFIER

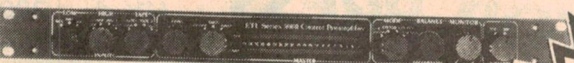
WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER.

- ★ 1% Metal Film resistors are used where possible.
  - ★ Aluminium case as per the original article.
  - ★ All components are top quality.
  - ★ Over 1000 of these kits now sold.
  - ★ Super Finish front panel supplied at no extra cost.
- Please note that the "Superb Quality" Heatsink for the Power Amplifier was designed and developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

**SPECIFICATIONS:** 150 W RMS into 4 ohms  
**POWER OUTPUT:** 100 W RMS into 8 ohms (±55 V SUPPLY)  
**FREQUENCY RESPONSE:** 8 Hz to 20 KHz, +0-0.4 dB 2.8 Hz to 65 KHz, +0-3 dB. NOTE: These figures are determined solely by passive filters.  
**INPUT SENSITIVITY:** 1 V RMS for 100 W output.  
**HUM:** 100 dB below full output (flat).  
**NOISE:** 116 dB below full output (flat, 20 KHz bandwidth).  
**2nd HARMONIC DISTORTION:** <0.001% at 1 KHz (0.0007% on Prototypes) at 100 W output using a ±56 V SUPPLY rated at 4A continues <0.0003% at 10 KHz and 100 W.  
**3rd HARMONIC DISTORTION:** <0.0003% for all frequencies less than 10 KHz and all powers below clipping.  
**TOTAL HARMONIC DISTORTION:** Determined by 2nd Harmonic Distortion (see above).  
**INTERMODULATION DISTORTION:** 0.003% at 100 W (50 Hz and 7 KHz mixed 4:1).  
**STABILITY:** Unconditional.

Cat. K44771.

Assembled and Tested \$499



## PREAMPLIFIER

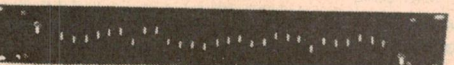
THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER KIT ARE:

- ★ 1% Metal Film Resistors are supplied.
  - ★ 14 Metres of Low Capacitance Shielded Cable are supplied (a bit extra in case of mistakes).
  - ★ English "Lorlin" switches are supplied (no substitutes here).
  - ★ Specially imported black anodised aluminium knobs.
- Available Assembled and Tested. (We believe that dollar for dollar there is not a commercial unit available that sounds as good.)

**SPECIFICATIONS:**  
**FREQUENCY RESPONSE:** High-level input: 15 Hz-130 KHz, +0 -1 dB Low-Level input - conforms to RIAA equalisation, ±0.2 dB.  
**DISTORTION:** 1 KHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).  
**S/N NOISE:** High-Level input, master full, with respect to 300 mV input signal at full output (1.2V) >92 dB flat > 100 dB A-weighted MM input, master full, with respect to full output (1.2V) at 5 mV input 50 ohms source resistance connected >86 dB flat >92 dB A-weighted MC input, master full, with respect to full output (1.2V) and 200 uV input signal >71 dB flat >75 dB A-weighted.

Cat. K44791.

Assembled and Tested \$599



## THIRD OCTAVE GRAPHIC EQUALIZER

**SPECIFICATIONS:**  
**BANDS:** 28 Bands from 31.5 Hz to 16 KHz.  
**NOISE:** <0.008 mV, sliders at 0, gain at 0 (-102 dB0).  
**20 KHz BANDWIDTH DISTORTION:** 0.007% at 300 mV signal, sliders at 0, gain at 0; maximum 0.01%, sliders at minimum.  
**FREQUENCY RESPONSE:** 12 Hz-105 KHz, +0, -1 dB, all controls flat.  
**BOOST AND CUT:** 14 dB.

Cat. K44590

1 Unit...\$199

2 Units...\$379

POST & PACKING: \$10 per SERIES 5000 KIT.

OUR PRICE  
\$289!

OUR PRICE  
\$249!

# Rod Irving Electronics!

## KIT CLEARANCE!

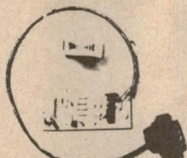
SAVE! SAVE! SAVE!



### ELECTRONIC MOUSETRAP

This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again! (ETI Aug '84) ETI 1524 Cat. K55240

\$29.95



### RADIOTELETYPE CONVERTER FOR THE MICROBEE

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receiver's audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr. '83)

**WAS \$20.00 NOW \$14.95**



### PH METER KIT

Build this pH meter for the swimming pool season is here again! From swimming pools to fish tanks to gardening, this pH meter has many applications around the home. This unit features a large 3 1/2 digit liquid crystal display and resolution to 0.1 pH units, making it suitable for use in the laboratory as well. (EA Dec. '82) 82PH12 Cat. K82123

\$139



### CYLON VOICE

Have your voice transformed into that of the sinister sounding Cylons. Great fun and scary! (EA Jan '81)

**WAS \$19.95 NOW \$14.95**



### 1W AUDIO AMPLIFIER

A low-cost general-purpose, 1 watt audio amplifier, suitable for increasing your computers audio level, etc. (EA Nov. '84) Cat. K84111

\$9.95



### UNIVERSAL RELAY BOARD

Operating a relay to switch heavy current or mains voltages is a common requirement in electronic control applications. This project permits a relay to be switched in a variety of ways and form a variety of inputs. (ETI May '81, ETI257)

**WAS \$13.50 NOW \$9.95**



### CUDLIPP CRICKET

A fascinating Electronic Cricket with just two ICs. The Cudlipp can be used to bug your home, office etc! Great fun! (EA Feb. '82) 82FC3 Cat. K82022

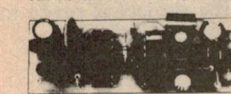
\$12.00



### PHONE MINDER

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or it can perform either function separately. (EA Feb. '84) 84TP2 Cat. K84021

\$24.00



### SOUND SIMULATOR FOR MODEL TRAINS

Fancy a diesel sound simulator for your model train layout? This circuit mounts inside the train for added realism and even varies its 'speed' according to the throttle setting. (EA Nov. '84) Cat. K84110

\$18.00



### BIPOLAR PROM PROGRAMMER

Every digital workshop should have one! Can be used to program the popular fusible-link PROMS like the 74S188-288, 82S23 & 82S123 etc (ETI June '83) ETI 688 Cat. K46880

\$49.50



### VOICE OPERATED RELAY

EA's great Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter or to control a slide projector. (EA Apr. '82) 82VX4

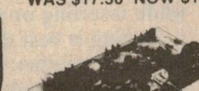
**WAS \$15.00 NOW \$10.95**



### 15W DUAL POWER SUPPLY

This simple project is suitable for most projects requiring a dual voltage. (ETI '81, June '76)

**WAS \$17.50 NOW \$12.95**



### PREAMP FOR PAGING AMP

A versatile preamp with separate bass, treble and volume. (ETI 1421)

**WAS \$20.00 NOW \$14.95**

## KITS FOR THE MICROBEEES!

For those of you with Microbees and to coincide with ETI's "Microbee lift out", we have compiled this special section of kits for Microbee computers!

regards, Howard Rider.  
General Manager



### COMPUTER DRIVEN RADIO-TELETYPE TRANSCIVER

Here's what you've been asking for, a full transmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microbee, tips are available on interfacing the unit to other computers. (ETI Nov. '84) ETI 755 Cat. K47550

\$139.00



### MICROBEE SERIAL-TO- PARALLEL INTERFACE

Most microcomputers worth owning have an RS232 connector, or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel Centronics interface printers. Save money by building this interface. (ETI Jan. '84) ETI 675 Cat. K46750

\$59.00

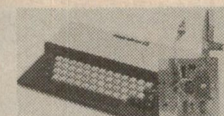


### ROM READER FOR MICROBEE

So you've written your 32K 'Adventure' program and you're impressing all your friends with the graphics and the witty text - but they're not impressed at how long it takes to load the goldmine program from tape! Then again, loading those short, useful utilities from tape takes a frustrating few minutes when you're hot to get on with the job. This project fixes that - transfer those tape programs to EPROM and load them with the ROM Reader. (ETI 678, ETI MARCH '84)

Cat. K46780

\$34.95

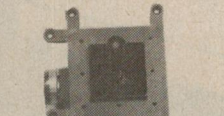


### MICROBEE EPROM PROGRAMMER

This simple, low cost EPROM programmer just plugs into the Microbee's I/O port and enables you to save programs in any of five different common EPROMs which can then be used in your MicroBee or any other microprocessor-based system. As the MicroBee I/O port is effected with a 280 PIO chip, this programmer can be used with any other system employing the same I/O. (ETI 668, ETI)

Cat. K46680

\$48.50

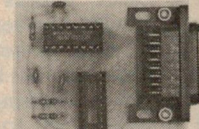


### MICROBEE PROPORTIONAL ANALOGUE JOYSTICK

The joy of a joystick! A twiddle of the fingers as your spaceships races through the cosmos, zapping space invaders and other various baddies with searing photon torpedoes. Or a tank on a battlefield, dodging the mines. Or your Tiger Moth bucks through the turbulence as your skillful fingers guide it gently towards a landing. Fasten your seatbelts, folks, because with this latest ETI project, you'll be joining the fun. (ETI 674, DEC '83)

Cat. K46740

\$49.50

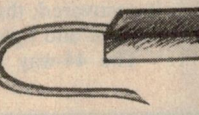


### MICROBEE PARALLEL PRINTER INTERFACE

Nick-named "the Bee pee interface", this project allows you to connect your Microbee to a printer having a 'parallel' or 'Centronics' input. It's simple to build and low in cost. (ETI 671, ETI OCT '83)

Cat. K46716

\$14.95



### HARD COPY FROM YOUR MICROBEE

Here is the 'cheap and simple' way to get printout from your Microbee. Teleprinters can be obtained for less than \$100 (as cheap as \$30, even!) and they make quite an acceptable substitute if you can't afford a 'real' printer. This project interfaces your Microbee to a teleprinter. (ETI 672, ETI OCT '83)

Cat. K46720

\$15.95

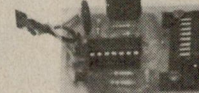


### FAIR DINKUM RS232 FOR MICROBEE

The Microbee, among other home computers, has a 'sort of' RS232 port in that it doesn't implement negative-going portion of its output signal (TxD). Most peripherals with an RS232 input can cope with that, but inevitably, there are those that can't. This project fixes that. (ETI 676, ETI FEB '84)

Cat. K67680

\$34.95



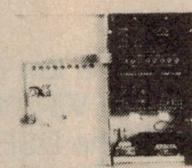
### MICROBEE LIGHT PEN

This simple, low cost device plugs into the Microbee's 8-bit port and gives you an 'entry' into the world of light pens and interactive software. (ETI 649, ETI August '83)

Cat. K46490

\$19.95

## LATEST KITS!



### MULTI SECTOR ALARM STATION

Protect your home from intruders with this up-to-the-minute burglar alarm system. Its easy to build, costs less than equivalent commercial units, and features eight separate inputs, individual sector control, battery back up and self-test facility.

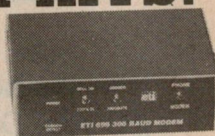
**Specifications:**

- Eight sectors with LED status indication.
- Two delayed entry sectors.
- Variable exit, entry and alarm time settings: entry delay variable between 10 and 75 seconds; exit delay variable between 5 and 45 seconds; alarm time variable between 1 and 15 minutes.
- Resistive loop sensing: suits both normally open and normally closed alarm sensors.
- Battery back-up with in-built charger circuit.
- Built-in siren driver.

Complete kit including deluxe prepunched metal work and electronics for only...

Cat. K85900

\$119



### 300 BAUD DIRECT CONNECT MODEM

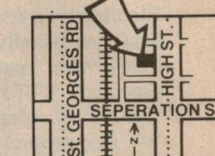
Modem? What do I want with a modem? Think of these advantages:

- Can't afford a floppy disc? Use your telephone to access one for the cost of a call.
- Bored with your old programs? Download hundreds of free programs.
- Want to get in touch with fellow computer enthusiasts? Use 'electronic mail'.
- Ever used a CPM system? CP-DOS? UNIX? Well a modem will make a computer a remote terminal on some of the most exciting systems around.

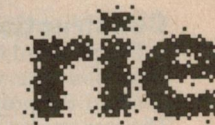
Save on ready build systems.

Cat. K85900

\$99



Just a reminder to all the people who live in Melbournes northern suburbs, that there's our NORTHCOTE store for your convenience!



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\$50-\$99.99	..... \$5.00
\$100-\$199	..... \$7.50
\$200-\$499	..... \$10.00
\$500 plus	..... \$12.50

This is for basic postage only, Comet Road freight, bulky and fragile items will be charged at different rates.



Errors and omissions excepted

# VZ-200 TERMINAL

With the addition of a low cost V.21 modem this project will get your Dick Smith VZ-200 talking to the world! Designed and developed by the DSE Research and Development team at North Ryde, the ETI-695 must be the cheapest way to get a 300 baud glass terminal going yet.

THE VZ-200 was very good 'value for money' when it was released by Dick Smith Electronics a few years ago. The last batch sold was heavily discounted and no doubt many were snapped up by ETI readers, especially RTTY enthusiasts after the ETI-756 RTTY adaptor appeared in Nov/Dec '84. This project extends the VZ's capability to operate as a 300 baud serial terminal. Although the VZ-200 is no longer available the unit will also work with the latest VZ-300 computer which has an improved keyboard.

## Construction

The pc board is designed to fit into a VZ expansion case which adds a professional finish to the project and is recommended. The case needs a bit of surgery to mount the DB-25S connector, so mark out the cut at the back of the 'top' half of the box (the

larger piece). The connector sits flush with the lip of the half-case. Drill the two mounting holes for the DB-25S and screw it in with the 12 mm x 4BA screws and nuts.

Check over the pc board before commencing construction, look for broken tracks, bridges and undrilled holes. The prototype pc board has been tinned and had a couple of holes covered by the solder. These are best handled by heating the spot with a soldering iron and a bit of solder wick, if you try and force the component leads through such blocked holes you run the risk of lifting the copper away from the board and breaking bits off.

Start off by soldering in the ten wire links. One of them is near a mounting hole and should be bent around the hole to leave it uncovered, the other nine links should be straight and tight.

The 44-way edge connector can go in

next. It mounts from the component side of the board (of course). The solder tails should be pushed through the board so that the bottom of the plastic part of the connector is flush with the copper side of the pc board. This is necessary to fit the finished pc board correctly into the case, so make sure the connector is aligned before soldering.

Some of the resistors mount on their ends. Be careful not to bend the leads too close to the resistor body to avoid breaking the leads off.

Solder in the capacitors before the diodes, since the two electrolytic caps are a wee bit close to diodes D4 and D5, which mount on their ends.

The two smaller transistors Q1 and Q2 can go in next, followed by Q3 which should be bent over if it is a BD139, as in the photograph. Solder the IC socket and the four ICs being careful to avoid solder bridges between the pins.

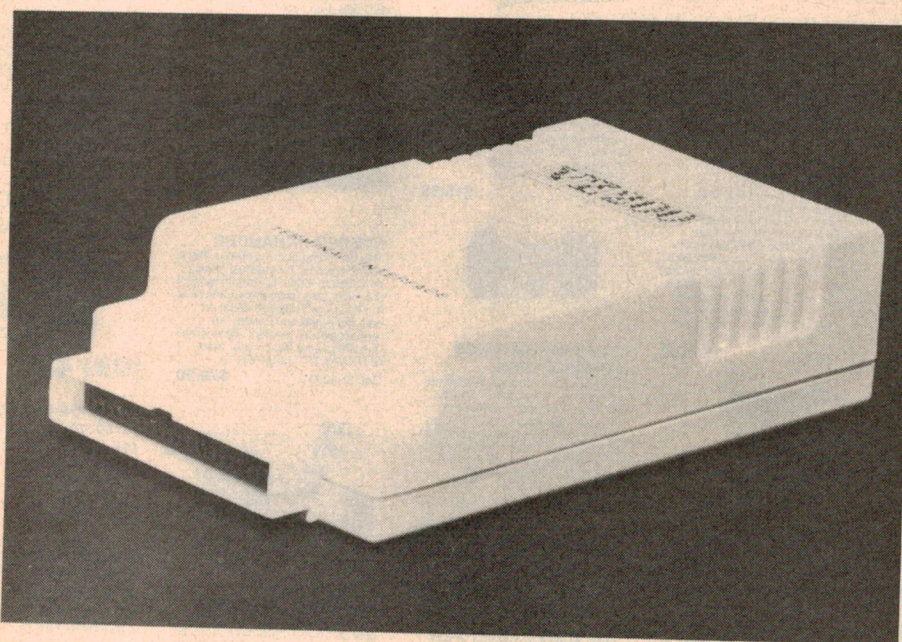
The three wires to the DB-25S connector were brought to the copper side of the pc board on the prototype; you may wire from the component side if you prefer before soldering.

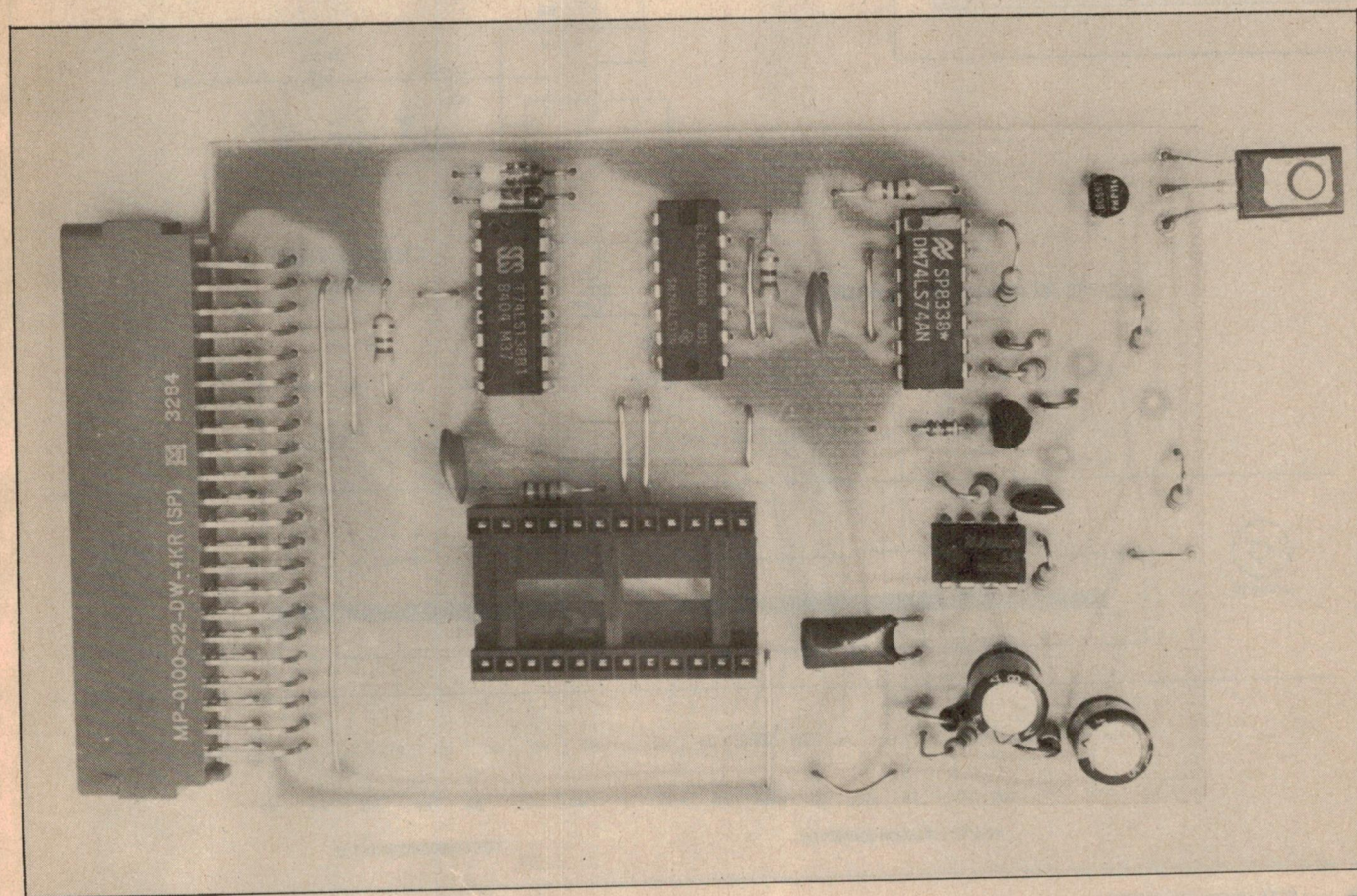
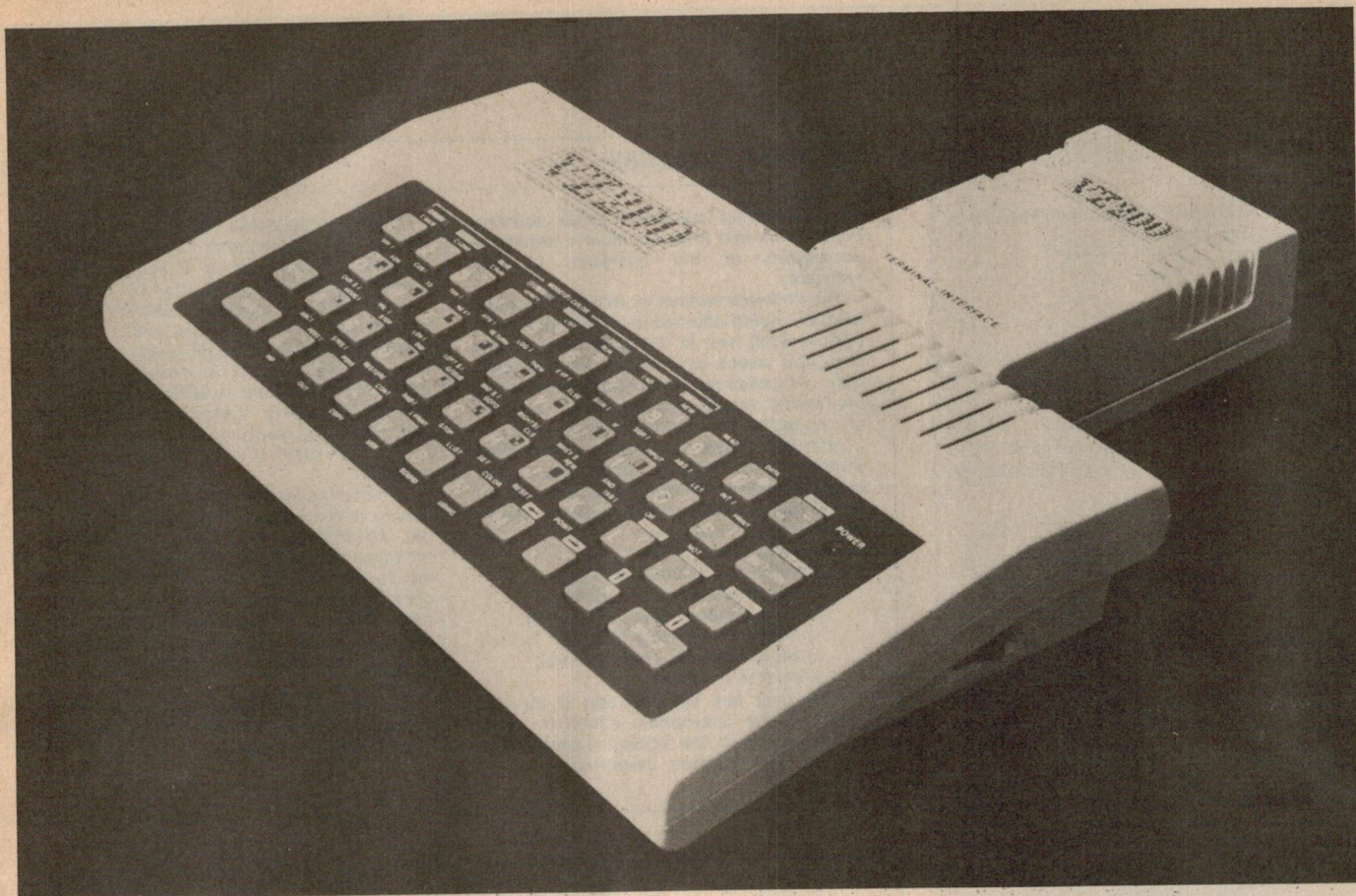
Place the bottom half of the case down and push the 44-way connector through the slot in the end with the copper side of the pc board uppermost. Align the two pc board holes with the mounting pillars and fit the top half of the case. Finish off by putting the case screws in and the project is ready to test.

## Testing

Make sure your VZ-200 is operating properly before connecting the project. The interface plugs into the memory expansion port which is the largest on the back of the computer. Power should be switched off while inserting or removing the unit.

Testing is best done with a 300 baud terminal (or another computer emulating one) otherwise you will have to call a friend or bulletin board with a modem. To actually ►





## PARTS LIST — ETI-695

NOTE — A complete kit of parts can be obtained from your Dick Smith store.

**Resistors.....all 1/4 W, 5%**

R1, 2, 3, 4, 10 .....	4k7
R5, 12 .....	1k
R6 .....	33k
R7, 11 .....	10k
R8, 9 .....	3k3
R13 .....	2k7

## Capacitors

C1, 2.....	100n ceramic
C3, 4.....	10n polyester (greencap)
C5, 6.....	100 $\mu$ 16 V RB electrolytic

## Semiconductors

IC1.....	74LS138
IC2.....	2516 "VZRS" EPROM V1.5 or later
IC3.....	74LS74
IC4.....	74LS33
IC5.....	'555 timer
Q1.....	BC548
Q2.....	BC557
Q3.....	BD139 or BC639
D1, 2.....	1N60 Ge diodes
D3.....	1N914
D4, 5.....	1N4002

### Miscellaneous

Printed circuit board "VZRS232"; VZ expansion case; 44-way female edge connector right angle pcb mounting; DB25S chassis socket; 2 x 12 mm 4BA screws and nuts; 24 pin DIP IC socket; tinned copper wire, hookup wire, solder, etc.

**Price estimate: \$49.95**

## SOFTWARE OPERATION

The VZ terminal interface is totally software based. This text is to serve as a functional description of the operation of this software.

The software resides in an EPROM on the interface board and maintains a data area in RAM at 8000 hex. In this data area are the flags and values used by the terminal software. At power-up these values are set to pre-defined values of 8 data bits, 1 stop bit and no parity. The unit is 300 baud only.

After the power-up sequence has been completed, the software goes into a loop waiting for keyboard input from the user. At this time the user can select one of seven menu options, these are:

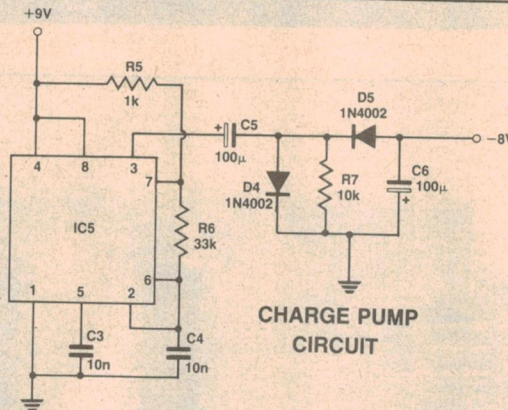
- 0) go to the terminal;
- 1) select full/half duplex;
- 2) toggle printer output on/off;
- 3) set number of data bits (7 or 8);
- 4) set number of stop bits (1 or 2);
- 5) set parity (odd, even or none);
- 6) set lf to cr option

If the user has selected one of the options 1-6, the appropriate action is taken and displayed on the screen. If option 0 is selected the software goes into terminal mode.

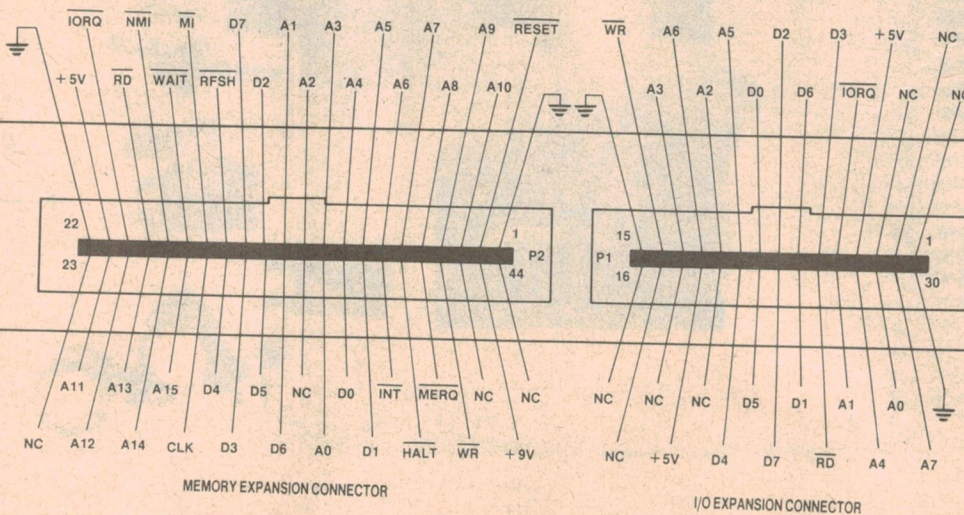
If the user selected option 0, the system begins looking for either keyboard input or incoming serial data. If a key has been pressed on the keyboard, then the software gets the value of that key, determines if it is a 'return to main menu' key (shift-x); if this is so it returns to the main menu, otherwise it sends the character to a routine that decodes it into bits and sends it serially to the interface hardware. It also adds start, stop and, optionally, parity bits. If the duplex option is set to half, it will echo to the screen as well.

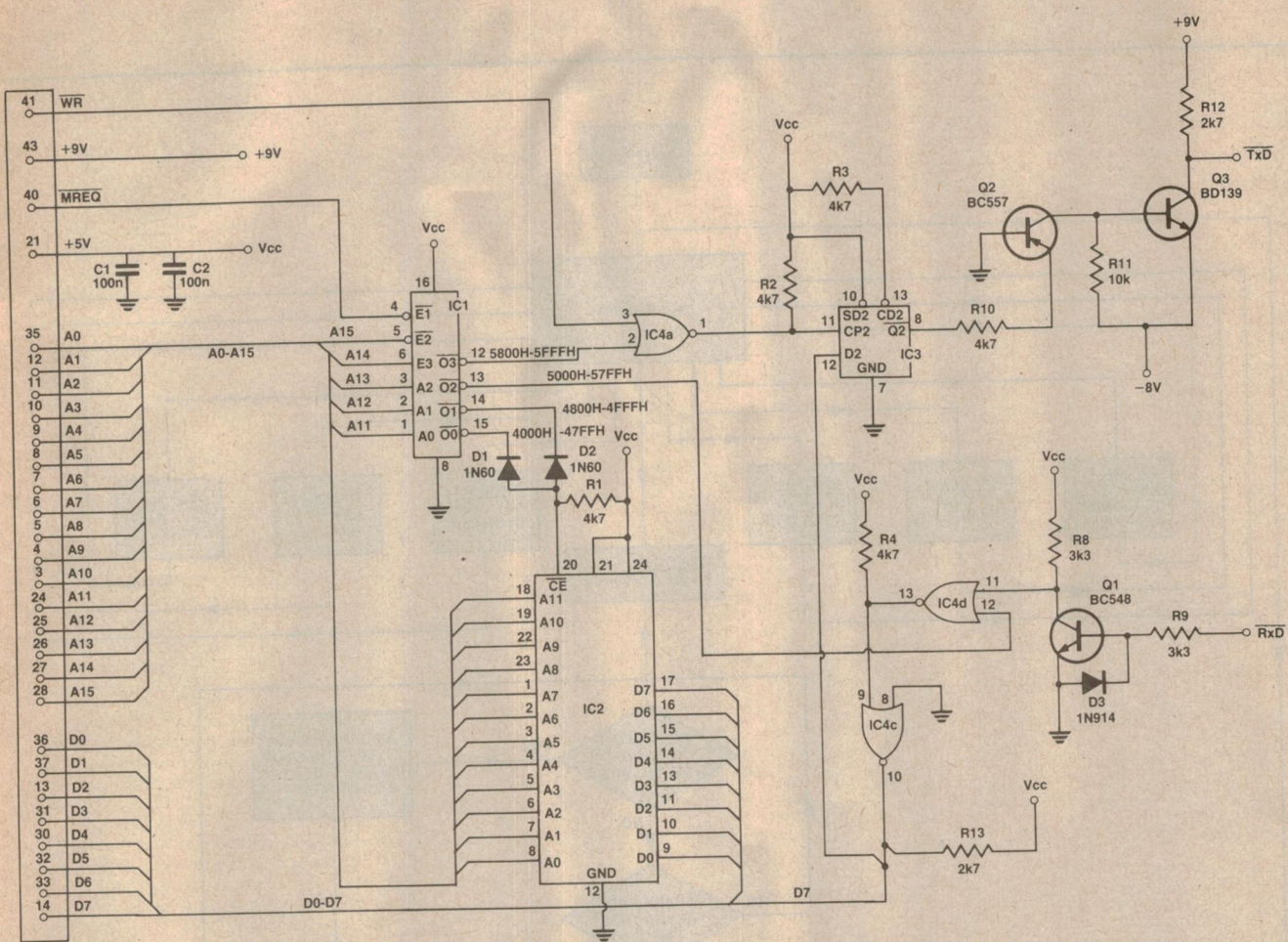
If incoming serial data is found (by detecting a transition from a stop to a start bit), the software goes into a loop, reading bit seven of a port and encoding the incoming serial data bits into a byte, taking due consideration to the state of the start bit, stop bit(s) and optionally the parity bit. After a valid character is assembled it is sent to the screen and optionally to the printer.

The terminal operation continues until it detects a shift-x key, at which time it returns to the main menu.

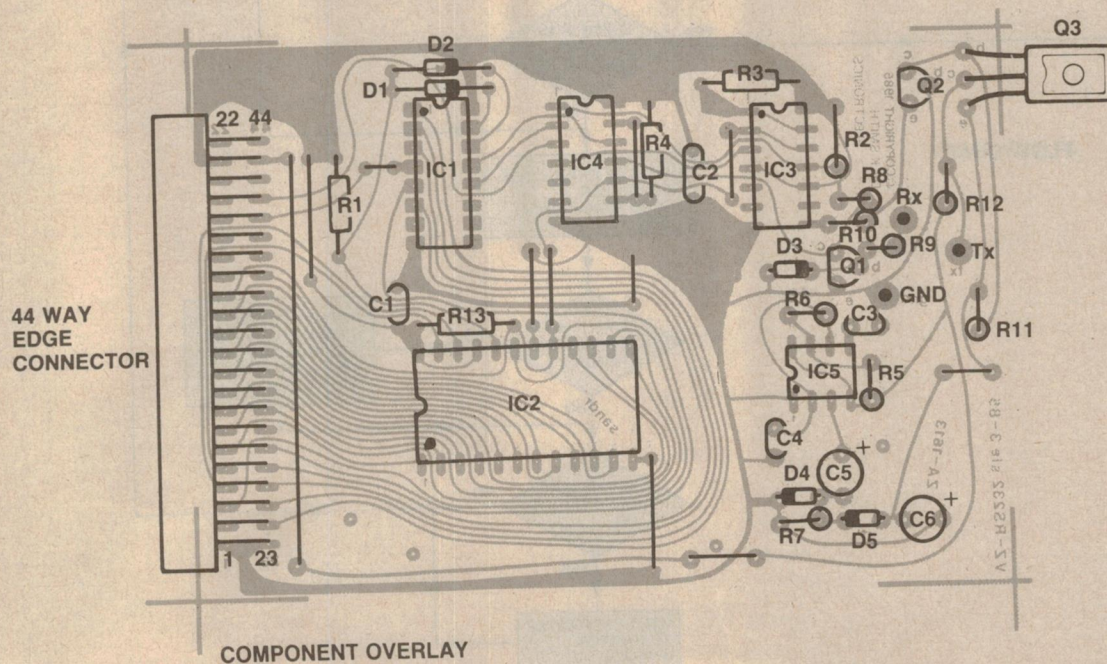


### VZ-200 REAR PANEL LAYOUT

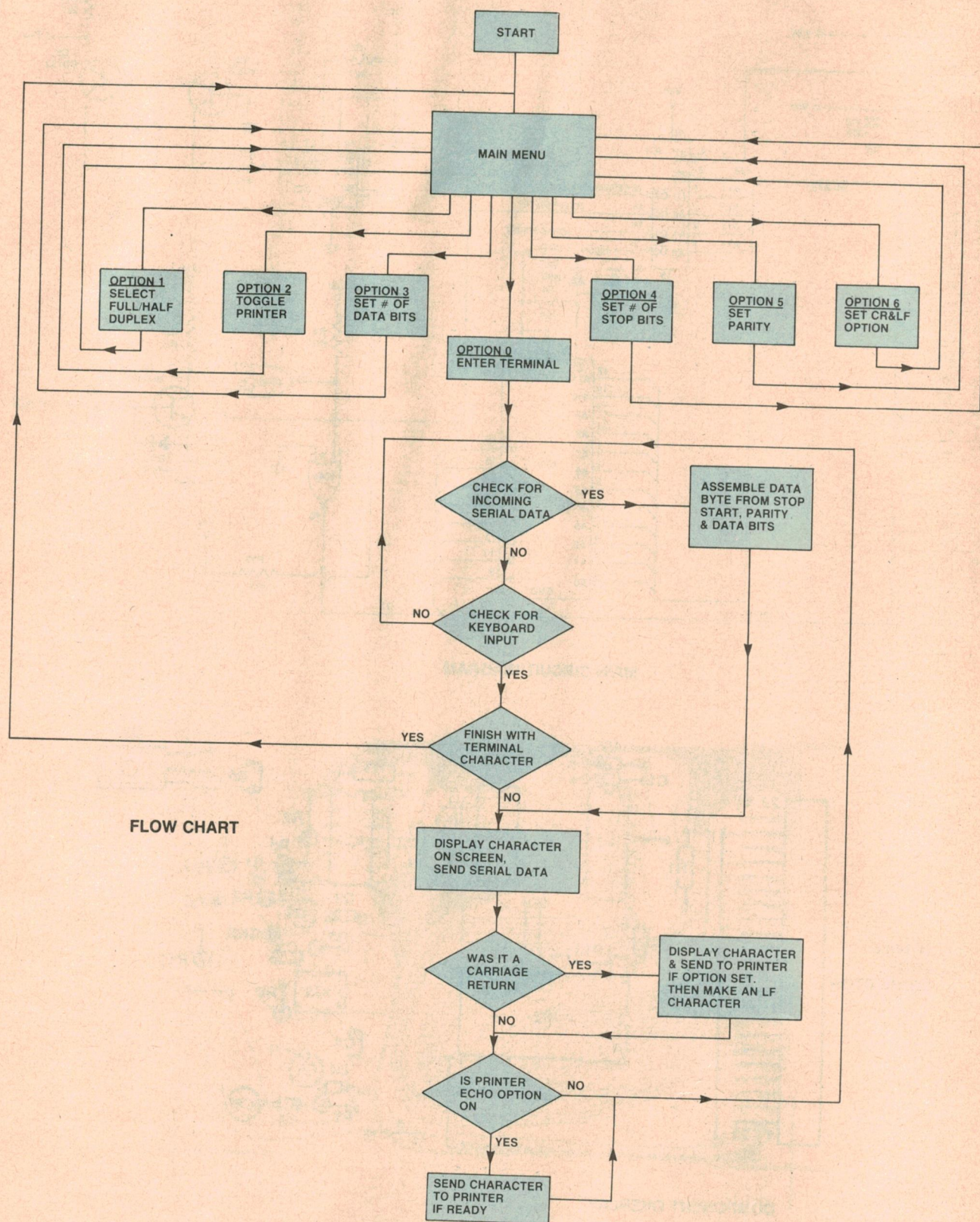




MAIN CIRCUIT DIAGRAM



COMPONENT OVERLAY



## HOW IT WORKS — ETI-695

The terminal interface provides a Dick Smith VZ-200 or VZ-300 computer with the hardware and software necessary to emulate a simple 300 bit/s terminal. The software supports full or half duplex operation and has a printer echo option to record the conversation.

### THE VZ-200 COMPUTER

The basic VZ-200 computer employs a Z80 microprocessor running at a clock speed of 3.58 MHz. Two 8K x 8 mask-programmed ROMs contain the Microsoft BASIC interpreter, while three 2K x 8 static RAMs provide program memory.

A 6847P-1 video controller chip and a further 2K x 8-bit static RAM form the heart of the computer's video section.

A simple software scanning scheme is used for the keyboard. The keys are arranged in eight rows, each of which can be pulled down to low logic level by diodes connected to the eight least significant address lines (A0-A7). The other sides of the keys are connected to six column lines, which are connected to six of the inputs of a gated octal buffer, and also to six pull-up resistors. The octal buffer's outputs are connected to the six least significant data lines of the processor (D0-D5).

Simplified decoding is used for selection of the various I/O devices in memory space. The memory address ranges occupied are as follows (in hexadecimal notation):

### VZ-200 MEMORY MAP (WITH TERMINAL)

0000-1FFF basic ROM 0  
2000-3FFF basic ROM 1  
4000-47FF terminal EPROM  
4800-4FFF spare space, can be used with 2532 EPROM  
5000-57FF receive data, data on data bit 7  
5800-5FFF transmit data latch, data sent on data bit 7  
6000-67FF not used in terminal  
6800-6FFF keyboard, cassette interface, speaker, VDC  
7000-77FF video RAM  
7800-8FFF inbuilt user RAM  
9000-FFFF reserved for memory expansion modules

Note that due to the simplified addressing, the output latch serving the cassette output, speaker and video display controller effectively occupies all addresses from 6800-6FFF inclusive. Similarly the keyboard/cassette input buffer also occupies all of this address

range, although the individual rows of keys effectively occupy discrete addresses.

For more information on the VZ-200 consult the VZ-200 Technical Reference Manual available from Dick Smith Electronics.

### THE TERMINAL HARDWARE

The project connects to the VZ-200 through the memory expansion connector (P2) and is memory mapped.

IC1 decodes the Z-80's address lines to provide select signals for the EPROM IC2, the transmit latch IC3 and the receive data gates.

The incoming RS232 signal is converted from a -12/+12 volt signal to a TTL compatible signal by T1, thence to IC4 where it is gated with the 5000-57FF enable signal. If this enable signal is true (active low) the received data is inverted and fed to data bit D7 where it is read by the terminal software.

The outgoing TTL signal is sent from data bit D7 to IC3 where it is latched. The clock for IC3 is provided by gating the processor write enable with the 5800-5FFF output from IC1. The output from IC3 is level shifted by T2 and T3 to obtain an RS232 compatible signal. The negative voltage used by T3 is generated in a charge pump circuit based on IC5, a '555 timer.

## SOURCE CODE

A complete documented source code listing of the software will be available on the Dick Smith Bulletin Board in the near future (according to Steven Engels of Dick Smith Electronics). The listing is too long to reproduce in the magazine. THE DSE-BBS is reached on: (02)887-2276 within Australia; +61 2 887-2276 on ISD.

The DSE-BBS is online 24 hours except on Fridays between 3 pm and 5.30 pm Eastern Standard Time.

### TECHNICAL INQUIRIES

As the complete project including software was developed at DSE, all inquiries about the VZ-200 terminal project should be directed to Dick Smith Electronics.

communicate you have to enter the terminal mode from the menu by typing 0.

Providing the character length, parity and stop bits are identical you should have no trouble using the ETI-695 as a simple terminal.

We had some problems using the printer echo command with an Admate DP-80 printer using version 1.5 of the VZRS EPROM. This may be fixed in later versions, after our publication deadline. ●

## HEXADECIMAL MACHINE CODE LISTING VZ-RS V1.5

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0100:	AA	55	E7	18	C3	84	41	4F	4E	20	4F	46	46	46	55	4C
0110:	4C	48	41	4C	46	0C	56	5A	2D	32	30	30	2F	33	30	30
0120:	20	52	53	2D	32	33	32	20	2D	20	56	45	52	53	49	4F
0130:	4E	20	31	2E	35	0D	28	43	29	20	31	39	38	35	20	44
0140:	49	43	4B	20	53	4D	49	54	48	20	45	4C	45	43	54	52
0150:	4F	4E	49	43	53	0D	2D	2D	2D	2D	2D	2D	2D	2D	2D	2D
0160:	2D	2D	2D	2D	2D	2D	2D	2D	2D	2D	2D	2D	2D	2D	2D	2D
0170:	2D	2D	2D	2D	2D	0D	30	5D	20	45	4E	54	45	52	20	54
0180:	45	52	4D	49	4E	41	4C	0D	31	5D	20	46	55	4C	4C	2F
0190:	48	41	4C	46	20	44	55	50	4C	45	58	3A	00	46	55	4C
01A0:	4C	0D	32	5D	20	54	4F	47	47	4C	45	20	50	52	49	4E
01B0:	54	45	52	20	20	3A	4F	46	46	0D	33	5D	20	53	45	54
01C0:	20	23	20	44	41	54	41	20	42	49	54	53	20	3A	38	20
01D0:	20	0D	34	5D	20	53	45	54	20	23	20	53	54	4F	50	20
01E0:	42	49	54	53	20	3A	31	20	20	0D	35	5D	20	53	45	54
01F0:	20	50	41	52	49	54	59	20	20	20	20	20	20	3A	4E	20

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0200:	20	0D	36	5D	20	41	44	44	20	4C	46	20	54	4F	20	43
0210:	52	20	20	20	20	3A	4F	46	46	0D	0D	2A	2A	2A	2A	2A
0220:	2A	2A	20	57	48	45	4E	20	49	4E	20	54	45	52	4D	49
0230:	4E	41	4C	20	2A	2A	2A	2A	2A	2A	2A	2A	20	20	53	48
0240:	49	46	54	20	2D	20	58	20	54	4F	20	45	58	49	54	20
0250:	54	45	52	4D	49	4E	41	4C	20	20	2A	2A	2A	2A	2A	2A
0260:	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A
0270:	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A	00	00	00	00
0280:	00	00	00	00	F3	31	00	90	21	9D	40	11	00	80	01	E7
0290:	00	ED	B0	3A	E1	80	F5	3E	01	32	E1	80	21	15	40	CD
02A0:	4D	43	21	00	80	CD	4D	43	F1	32	E1	80	CD	50	34	21
02B0:	93	41	E5	CD	66	44	B7	28	FA	D6	30	38	F6	FE	07	30
02C0:	F2	21	CE	41	87	5F	16	00	19	5E	23	56	EB	E9	56	42
02D0:	DC	41	F7	41	38	42	47	42	0B	42	01	42	3A	E0	80	B7
02E0:	3E	01	21	11	40	28	04	AF	21	0D	40	32	E0	80	11	00
02F0:	80	01	04	00	ED	B0	C9	21	DF	80	11	19	80	CD	21	42

continued ►

## MACHINE CODE LISTING CONTINUED

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0400:	00	18	04	FE	4F	18	F4	32	00	58	CD	23	43	3A	49	80
0410:	D6	30	47	AF	32	00	58	CD	23	43	10	F7	C9	3A	00	50
0420:	CB	7F	C9	F5	C5	CD	2E	43	CD	2E	43	C1	F1	C9	C5	3E
0430:	23	06	0B	10	FE	3D	20	F9	C1	C9	CD	2E	43	C5	3E	22
0440:	18	EF	F5	C5	01	FF	4F	CD	60	00	C1	F1	C9	7E	B7	C8
0450:	CD	6E	43	23	18	F7	21	00	70	22	E5	80	11	01	70	01
0460:	FF	01	36	60	ED	B0	AF	32	E4	80	32	00	68	C9	F5	E5
0470:	C5	D5	CD	7A	43	D1	C1	E1	F1	C9	ED	5B	E5	80	FE	0C
0480:	28	D4	FE	0D	28	7E	FE	08	28	35	FE	09	28	16	FE	0A
0490:	28	4A	FE	07	CA	50	34	CB	7F	20	08	FE	20	F8	CD	5D
04A0:	44	CB	F7	12	13	ED	53	E5	80	3A	E4	80	3C	32	E4	80
04B0:	FE	20	F8	CD	F3	43	3A	DF	80	B7	C8	CD	49	44	C9	3A
04C0:	E4	80	B7	28	0A	3D	32	E4	80	1B	ED	53	E5	80	C9	E5
04D0:	21	00	70	B7	ED	52	E1	C8	3E	1F	18	EA	3A	E4	80	4F
04E0:	06	00	C5	CD	F3	43	C1	EB	09	EB	ED	53	E5	80	79	32
04F0:	E4	80	C9	3A	E1	80	F5	3E	01	32	E1	80	CD	04	44	F1

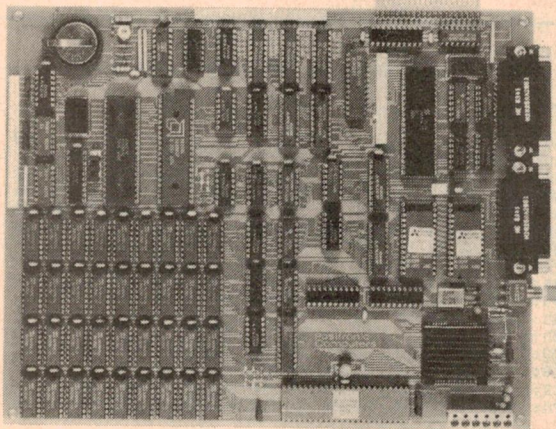
ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0500:	32	E1	80	C9	E5	EB	3A	E4	80	5F	16	00	B7	ED	52	3A
0510:	E1	80	B7	28	04	11	20	00	19	EB	21	00	72	B7	ED	52
0520:	28	0A	ED	53	E5	80	AF	32	E4	80	E1	C9	21	20	70	11
0530:	00	70	01	E0	01	ED	B0	21	E0	71	11	E1	71	01	1F	00
0540:	36	60	ED	B0	11	E0	71	18	D9	CD	C4	05	CB	47	C0	CD
0550:	E2	3A	C9	CD	C4	05	CB	47	C0	79	C3	8D	05	FE	61	D8
0560:	FE	7B	D0	E6	5F	C9	21	FE	68	0E	08	06	06	7E	F6	04
0570:	1F	30	58	10	FB	CB	05	0D	20	F1	06	04	21	DF	68	7E
0580:	CB	57	28	3D	CB	05	7E	CB	57	28	3A	CB	05	CB	57	28
0590:	38	CB	05	CB	05	7E	CB	57	28	11	CB	05	7E	CB	57	28
05A0:	11	3E	FF	32	E2	80	AF	32	E3	80	C9	3A	E3	80	CB	D7
05B0:	18	05	3A	E3	80	CB	CF	32	E3	80	3E	FF	32	E2	80	AF
05C0:	C9	0E	03	18	06	0E	02	18	02	0E	01	21	05	45	1E	00
05D0:	3A	E3	80	CB	57	28	04	1E	60	18	06	CB	4F	28	02	1E
05E0:	30	3E	08	91	4F	3E	06	90	47	CD	FA	44	83	06	00	4F
05F0:	09	7E	21	E2	80	BE	28	C7	77	C9	AF	B9	28	05	C6	06

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0600:	0D	20	FB	80	C9	54	57	20	45	51	52	47	53	20	44	41
0610:	46	42	58	20	43	5A	56	35	32	20	33	31	34	4E	2E	20
0620:	2C	20	4D	36	39	2D	38	30	37	59	4F	0D	49	50	55	48
0630:	4C	3A	4B	3B	4A	00	00	00	00	00	00	00	00	00	00	00
0640:	00	00	65	00	00	00	00	25	22	20	23	21	24	00	3E	00
0650:	3C	00	5C	26	29	3D	28	40	00	00	00	00	00	00	00	00
0660:	3F	2A	2F	2B	00	14	17	00	05	11	12	07	13	00	00	01
0670:	06	02	18	00	03	1A	16	00	00	00	00	00	00	0E	00	00
0680:	00	00	0D	00	00	00	00	00	00	19	0F	00	09	10	15	08
0690:	0C	00	0B	00	0A	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06A0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06B0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06C0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06D0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06E0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
06F0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

ADDR	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0700:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0710:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0720:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0730:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0740:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0750:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0760:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0770:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0780:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
0790:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07A0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07B0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07C0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07D0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07E0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
07F0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

## -186 80186 SINGLE BOARD COMPUTER



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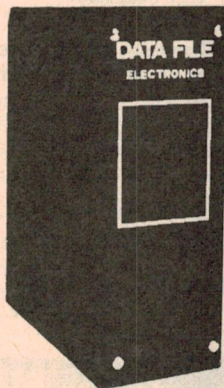
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Suits all A4 size publications (275 x 210). Very smart Royal Blue colour with beautiful gold embossing.

B 9999.....\$5.50

**THIS MONTH \$5.00**

4 or more \$4.50 ea.



## UTILITY PARTS CASE

Featuring a clear plastic lid so you can tell contents at a glance. Simple slide lock, 48 partition combinations. Very sturdy ABS plastic. A must for the Technical, Handyman, Hobbyist, Collector.

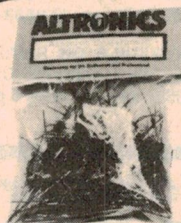


H 0449  
**\$17.95**

## NEW

**Metal Film Resistor Pack**  
150 Pcs  
Computer Selected

R 3505 **\$5.95**



## Other Pack Bargains

All computer selected values mix  
All \$5.95 Per Pack

- R 3501 Carbon film resistors .25W PK 300
- R 3510 Greencap Capacitors PK 50 pcs
- R 3515 Ceramic Capacitors PK 100 pcs
- R 3520 PC Mount Electrolytics PK 40 pcs

## MICROWAVE OVEN LEAK DETECTOR



Completely passive project receives microwaves via an antenna which develops a voltage across a detector diode driving the meter. Monitor your microwave oven with this easy to build kit. All components mount on single PCB including the meter.

K1724.....(still only) **\$14.50**

Uses Patented Complex Sonic Pattern developed by Professor J.L.Stewart—the man who invented the Bionic Ear.

## ULTRASONIC PEST REPELLER

Get rid of Mice, Birds, Spiders, Bats, Rats, Cockroaches, Fleas, Moths, Blowflies or other flies.

The VermineX Insect Repeller is the answer—creating a sonic environment totally hostile to the rodent/insects mentioned above.



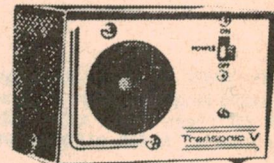
**VermineX Domestic Unit \$99**

This unit will cover an uninterrupted area of up to 2000 sq.ft. It has two pitch settings for different applications. (Instructions supplied). Supplied with 240V adaptor, but will run on a 9V alkaline cell. Dimensions: 110(w) x 65(h) x 40(d)mm Cat.A 0080

## VermineX Commercial Unit

**\$149**

Ideal for larger or more open areas. This unit has 9 pitch settings and offers more comprehensive protection from unwanted visitors. Also covers an uninterrupted area of up to 2000 sq.ft. and is supplied with AC adaptor. Dimensions: 120(w) x 80(h) x 80(d)mm Cat.A 0075



## How Does It Work?

The normal household, or office environment is normally devoid of ultrasonic sounds (ultrasonic sound being way above human hearing range!) Evolution has not had a reason to equip insects, rodents etc. with a protective sensory mechanism to guard against ultrasonic noises or sound. When subjected to a particular ultrasonic pattern, the creature begins to behave in a predictable manner. The pest becomes disoriented, lithargic and bewildered. The reaction is to escape from the sound effected area. The sonic pattern is the secret and this is a combination of scores of frequencies mixed together. The pattern was developed by Professor J.L.Stewart (who developed the Bionic Ear) **It Works!**

Initially we ourselves were sceptical we asked "if its so good why haven't we heard of them before?" or surely as ultrasonics are not new if the thing is any good they would have been on the market years ago. Well these have been ultrasonic repellers around—but none of them used the Stewart complex sonic pattern, consequently past results were uninspiring.

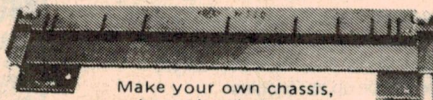
**Testimonials** — In our files we have copies of numerous letters testifying to the incredible effectiveness of the VermineX Repeller. The letters are from **Australian Universities, Animal Husbandry establishments, Piggeries, Restaurants etc.** Many of them had severe pest problems. Your pest problems may not be as bad—however, we believe the New VermineX Pest Repeller will be of enormous benefit to the average householder. We are so confident of this product we make the following **Guarantee**—Buy the VermineX, use as instructed, and if not completely satisfied you may return to us in as sold clean condition within 14 days (21 days for Mail Order customers) for a complete refund.

The Repeller serves an area of 2000 square feet (uninterrupted) and is not cheap. However, if the idea of dangerous chemicals, insecticides, sprays and baits worries you, the VermineX is a great solution. Supplied with plug pack for 240V operation. Can be battery operated.

## PANBRAKE SHEET METAL BENDER

OVER 1000 SOLD

Our Panbrake Sheetmetal bender continues to be one of our most popular tools. Just the shot for making up heatsinks, brackets, chassis etc.



Make your own chassis, boxes brackets etc.

Unique slotted upper clamping bar allows complex corner bends etc.

Handles up to 16 gauge metal and up to 445mm wide.

T 2400 *Direct import price!* **\$89.95**

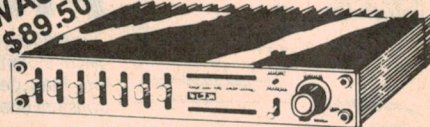
## IMPORT SCOOP

**Quality Commonwealth Computer Fan 80MM - 240V**

- ★ Super quiet ★ Sealed sleeve bearings for long life
- ★ Sturdy die cast frame ★ Operating range -10 deg C to + 70 C

## SUPERB QUALITY SLIMLINE GRAPHIC EQUALISER / AMPLIFIER

WAS \$89.50



Incredibly compact 22H x 145W x 132D. 7 Key 30W/30W Led Level meters/Qual Japan Marf. Freq. Response 20HZ-30KHZ... C 9132

**ONLY \$55**

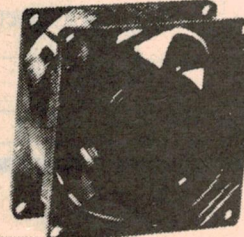
CAT F 1020

**\$12**

4 or More

**\$11**

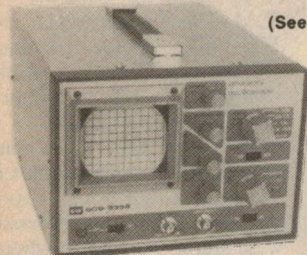
Amazing Value



## BUILD THESE FABULOUS KITS

### OSCILLOSCOPE SENSATION!

(See EA Oct '84)



K 2000  
Only  
\$249

Over the years many people have asked, "Do you have a CRO kit?"—Our answer—up until now—has been that built and tested units were not dearer than kits, if you could get a kit at all. The Altronic K 2000 Cathode Ray Oscilloscope kit has a guaranteed 5MHz band width but should go to around 6.5MHz. It also features 75mm (3") CRT Blue Phosphor with accurate graticule, separate vertical and horizontal BNC type input sockets etc. Remember, a 5MHz scope is usually adequate to troubleshoot most micro processor and other digital circuitry as well! This is a wonderful opportunity to learn electronics and end up with a valuable piece of test equipment as well. The Altronic K 2000 kit is absolutely complete. The chassis is prepunched and every component including nuts and screws are provided, along with instructions.

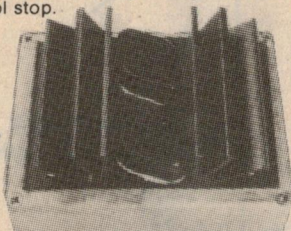
### TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION

KEEP YOUR ENGINE IN TOP TUNE

Yes, it's bad enough paying \$2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop.

K 4010  
\$35.00

Value Plus



This unique electronic ignition system will easily double the interval between tune ups. Plugs and Points stay in top condition for much, much longer.

Greatly reduced plug breakdown at high rev's. **Dead easy to build and (even better) there are only 3 electrical connectors required to the car wiring system.**

(See EA Mag. Jan '85)

Protect your Home or Business from Intruders with this "State of the Art" Burglar Alarm.

#### FEATURES:

- Alarm has 8 separate input circuits—8 sectors can be monitored independently.
- Each input circuit is provided with an indicator LED and a sector On/Off switch
- Individual sector isolation allows the user to have some areas of the premises habited while others remain protected e.g. Inside Off/Outside On.
- Inputs accept both normally closed and normally open sensors
- Two inputs provided with an entry delay (between 10 - 75 seconds)
- Internal trip warning buzzer—alerts owner/occupant of pending alarm operation—great for the "forgetful" amongst us. This buzzer is pre-settable between 5 and 55 seconds prior to Alarm.
- Unique circuit detects automatically when any N/O or N/C loops are either open circuit or dead short. e.g. someone trying to bridge reed switches etc.
- Switched output can be used to send a silent alarm through an auto-dialler circuit or similar.
- Full battery back up provided via. 12V—1.2Ah battery
- Supplied in an attractive functional security case.

K 1900 A Mere \$139.00

### STATE OF THE ART

#### The Avtek MultiModem

a breakthrough in low cost modem design Using state-of-the-art VLSI integrated circuitry, the Avtek MultiModem provides the highest standards of reliability for data communications on public phone lines. Digital signal processing is used to achieve functions normally requiring analogue filters.



MULTIMODEM NEVER REQUIRES ADJUSTMENT

MULTIMODEM WORKS RELIABLY ON LINES WHERE OTHER MODEMS CAN'T FUNCTION Its digital filters are much sharper than on conventional modems. Line interference is screened out. You get error free data transfer, even on very noisy lines.

#### MULTISTANDARD OPERATION

CCITT and Bell Duplex and Half Duplex.

#### AUTO ANSWER OPTION (MODEL D 1205)

Autoanswer is the ability of your computer/modem to receive when the phone rings. Some computer/software combinations do this. MultiModem offers the alternative for computers without this facility—hardware autoanswer. Leave your computer waiting for information.

#### TEST FUNCTIONS

DIG: This function enables the user to test the modem's operation over a line, testing both modem and line.

ANL: Provides testing of computer, software, cabling and modem.

#### SPECIFICATIONS

Data Standards: CCITT V.21 & V.23 Bell 103 & 22

Data Rates: 300, 600 & 1200 BPS

Backward Channel: 75 BPS in conjunction with 1200 BPS

Computer Interface: CCITT V.24 (RS232C)

Power Requirements: 240 VAC Power drain—3 watts

#### TWO MODELS

D 1200 (Standard) \$349.00

D 1205 with auto answer \$389.00

# ALTRONICS COMPONENTS

105 STIRLING STREET, PERTH  
FOR INSTANT SERVICE  
PHONE ORDER TOLL FREE  
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**\$3.00 DELIVERY AUSTRALIA WIDE** -We process your order the day received and despatch via. Australia Post. Allow approx. 7 days from day you post order to when you receive goods. Weight limited 10Kgs.

**\$5.00 OVERNIGHT JETSERVICE** - We process your order the day received and despatch via. overnight jetservice Courier for delivery next day Country areas please allow additional 24-48 hours. Weight limit 3Kgs.

**\$10.00 HEAVY HEAVY SERVICE** - All orders of 10Kgs. or more must travel Express Road - Please allow 7 days for delivery.

**INSURANCE** - As with virtually every other Australian supplier, we send goods at consignees risk. Should you require comprehensive insurance cover against loss or damage please add 1% to order value (minimum charge \$1). When phone ordering please request "Insurance".

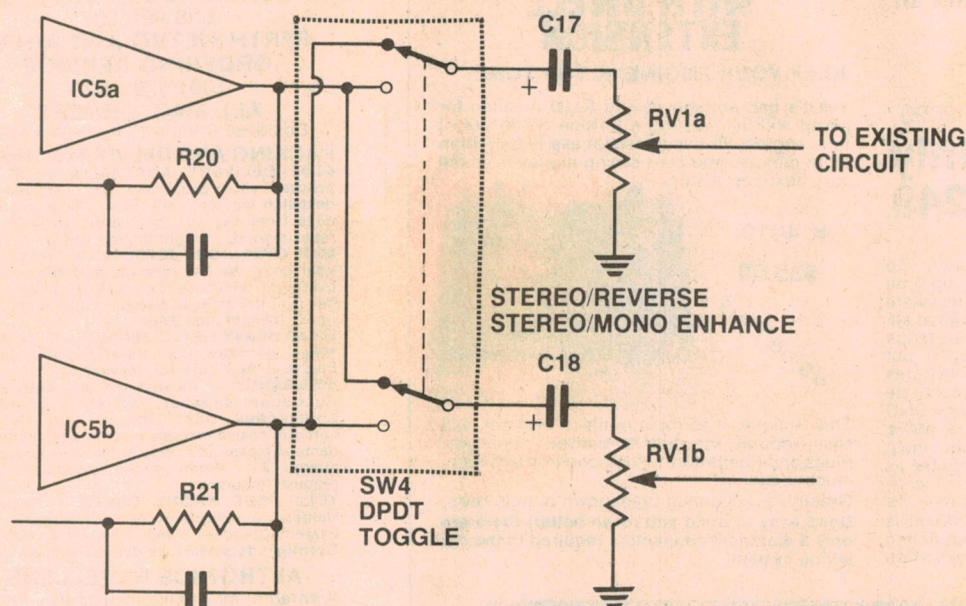
**TOLL FREE PHONE ORDER** - Bankcard Holders can phone order toll free up to 6pm Eastern Standard Time. Remember with our Overnight Jetservice we deliver next day.

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Wanted in all Areas of Australia—Phone Steve Wroblewski on (09) 381 7233 for Details

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<b>08SUBURBAN CARLINGFORD</b> Jaycar ..... 872 4444	<b>SUBURBAN FORTITUDE VALLEY</b> McGraths Electronics ..... 832 3944	<b>MAGRATHS</b> Electronics ..... 347 1122
<b>CONCORD</b> Jaycar ..... 745 3077	<b>ST LUCIA</b> Electronics ..... 523547	<b>SUBURBAN BENTLEIGH</b> Absolute Electronics ..... 557 3971
<b>GORE HILL</b> Jaycar ..... 439 4799	<b>PADDINGTON</b> Jacques Electronics ..... 369 8594	<b>BOX HILL SOUTH</b> Eastern Communications 288 3107
<b>HURSTVILLE</b> Jaycar ..... 570 7000	<b>COLOURVIEW</b> Wholesale Electronics ..... 2753188	<b>CHELTENHAM</b> Talking Electronics ..... 550 2386
<b>LEWISHAM</b> PrePak Electronics ..... 569 9770	<b>SLACKS CREEK</b> David Hall Electronics ..... 2088808	<b>DONCASTER</b> Clipstone Electronics ..... 84 2868
<b>08COUNTRY ALBURY</b> Webb's Electronics ..... 25 4066	<b>TOOWONG</b> ECO Technics ..... 3710879	<b>FOOTSCRAY</b> Acron Electronics ..... 689 1911
<b>BATHURST</b> The Electronics Shop ..... 31 4421	<b>COUNTRY CAIRNS</b> Thompson Instrument Services ..... 512404	<b>SOUTH CROYDON</b> Truscott Electronics ..... 723 3860
<b>BROKEN HILL</b> Crystal TV ..... 4803	<b>BUNDABERG</b> PM Electronics ..... 728 272	<b>COUNTRY BENDIGO</b> Nambour Electronics ..... 411604
<b>COFFS HARBOUR</b> Coffs Harbour Electronics ..... 52 5684	<b>GLADSTONE</b> Purley Electronics 724321	<b>MORWELL</b> Morwell Electronics ..... 34 6133
<b>GOSFORD</b> Tomorrows Electronics ..... 24 7246	<b>NAMBOR</b> Nambour Electronics ..... 411604	<b>ROBINVALE</b> John Mason Electronics ..... 26 3643
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## IDEAS FOR EXPERIMENTERS



### ETI-1405 mod.

T. J. Threifall writes that the ETI-1405 Stereo Enhancer (March 1985) is an excellent solution to the problem of closely-spaced speakers.

However, there is a simple modification which enables it to be used to solve the opposite problem: that of excessively wide stereo separation when listening to TV/FM 'simulcasts' in a room with loudspeakers at the corners. The width of the sound does not seem to enhance the quality of entertainment — the sound and picture don't come across as being related.

The ETI-1405 with the suggested modification is ideal as a buffer and stereo/reverse, stereo/mono/enhanced unit.

## 'IDEA OF THE MONTH' CONTEST

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month we will be giving away a 60 W Portable Cordless Soldering Iron, a 240 Volt Charging Adaptor together with a Holder Bracket. The prize is worth approx. \$100.

Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each person will be paid \$20 for an item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

### COUPON

Cut and send to: Scope/ETI 'Idea of the Month' Contest, ETI Magazine, P.O. Box 227, Waterloo NSW 217.

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea in ETI Magazine or other publications produced by it. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright."

\* Breach of copyright is now a criminal offence.

Title of Idea .....

Signature ..... Date .....

Name .....

Address .....

Postcode .....



### RULES

This contest is open to all persons normally resident in Australia, with the exception of members of the staff of Scope Laboratories, The Federal Publishing Company Pty Limited, ESN, The Litho Centre and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked to and including the date of the last day of the month.

The winning entry will be judged by the editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words, you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

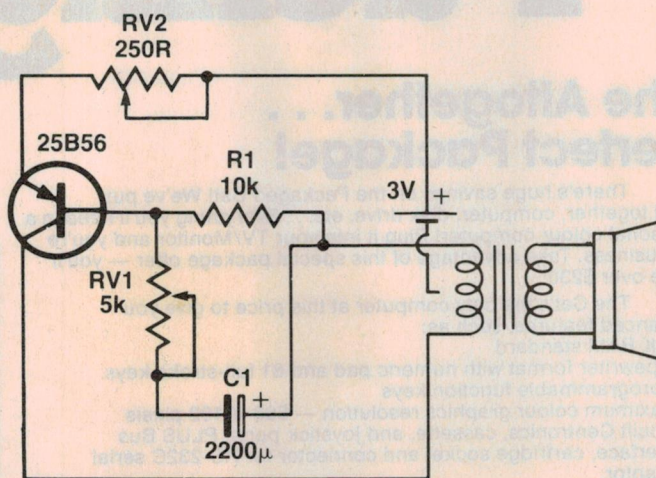
This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

Referring to the original circuit, with the top of RV1a connected to output of IC5a, and RV1b connected to IC5b, outputs are as follows: pot at 0 gives L and R, pot at 50% gives  $3L/2 - R/2$  and  $3R/2 - L/2$ , while the pot at 100% gives  $2L - R$  and  $2R - L$  — enhanced.

By using a DPDT switch as shown, i.e. swapping the connections of the IC outputs to the pot, the following outputs will be obtained: pot at 0 gives L and R, pot at 50% gives  $(L+R)/2$  and  $(R+L)/2$ , i.e. mono, and pot at 100%, R and L, i.e. reverse stereo. Positions in between those shown will give a continuous range of narrowing of the stereo effect (but remember to use a linear pot for RV1).

## Sound Effects Generator

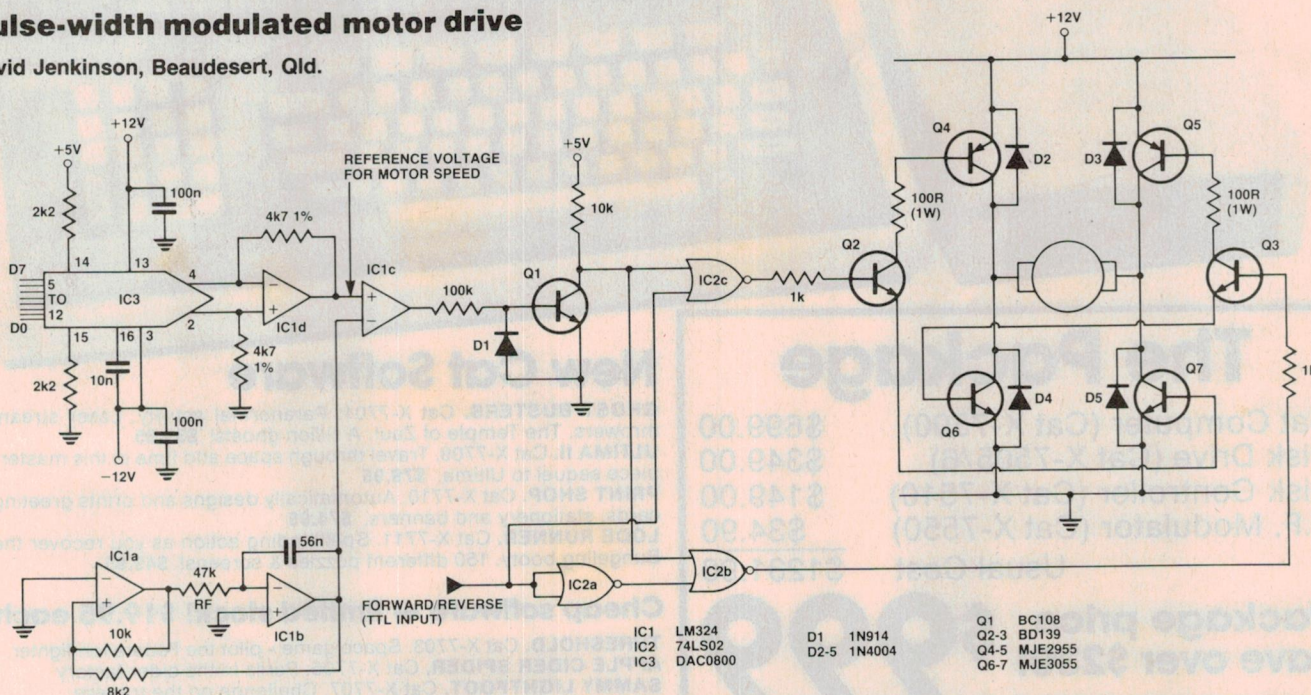
This circuit was sent to us by **Tom Mollenmane**, aged 14. It is a simple sound generator, the frequency depending on the values in the RC network consisting of R1, C1 and VR1. The variable resistor VR2 is inserted to let you make allowance for changes in the battery voltage as it decays.



## IDEA OF THE MONTH

### Pulse-width modulated motor drive

David Jenkinson, Beaudesert, Qld.



The following circuit was designed as the basis of a velocity control system for a small robot platform. However it may be used to control any small (up to 4 amp) permanent magnet dc motor, eg a slot-car or model train.

The circuit uses pulse-width modulation to control the motor speed. The velocity set-point is output from the computer to the DAC. A TTL-level signal is used to control the direction of rotation.

IC1a and IC1b form a triangle-

wave oscillator which is compared with the set-point voltage by IC1c to vary the mark/space ratio of the pulse train. The frequency of the pulse-width signal is approximately 120 Hz but can be altered by varying rf.

By adding a velocity trans-

ducer to the output shaft of the motor, closed-loop control can be implemented by a computer algorithm.

# Packaged Cat

## The Altogether... Perfect Package!

There's huge savings on the Packaged Cat! We've put it all together, computer, disk drive, etc. . . Everything you'll need in a personal colour computer! Plug it into your TV/Monitor and you're in business. Take advantage of this special package offer — you'll save over \$230!

The Cat's the only computer at this price to give you advanced features, such as:

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The Cat has an incredible range of software options. And it's also software compatible with most programs for the Apple II series. So there's no end to the availability of top quality programs! Take advantage of our special Packaged Cat — Save money! You'll wish you were home — so you could get the Cat out of the bag.

**THOUSANDS SOLD!**

Monitor shown  
not  
included  
in package



## The Package

Cat Computer (Cat X-7500)	\$699.00
Disk Drive (Cat X-7505/6)	\$349.00
Disk Controller (Cat X-7510)	\$149.00
R.F. Modulator (Cat X-7550)	\$34.90
Usual Cost	\$1231.90

**Package price** **\$999**  
**save over \$230!**

## New Cat Software

**GHOST BUSTERS.** Cat X-7701. Paranormal activity. Laser stream throwers. The Temple of Zuul. A zillion ghosts! **\$39.95**

**ULTIMA II.** Cat X-7709. Travel through space and time in this masterpiece sequel to Ultima. **\$79.95**

**PRINT SHOP.** Cat X-7710. Automatically designs and prints greeting cards, stationery and banners. **\$74.95**

**LODE RUNNER.** Cat X-7711. Spellbinding action as you recover the Bungeling booty. 150 different puzzles & screens! **\$49.95**

## Cheap software — limited stock! \$19.95 each

**THRESHOLD.** Cat X-7703. Space game — pilot the Federation fighter.

**APPLE CIDER SPIDER.** Cat X-7705. Perils in the cider factory

**SAMMY LIGHTFOOT.** Cat X-7707. Challenge on the trapeze.

**MR. COOL.** Cat X-7708. Hot new game — hop to avoid the heat!

*Dick Smith Electronics Pty Ltd*

**COMPUTERSTOP**



# Save, save, save!

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Cat X-5300

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	Usually	Now
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**Buy 5 of any combination below  
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Single sided, double density HARD sector Cat X-3505	<b>\$4.95ea.</b>
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or FREE with 5 disks!

**Amazing bargain on  
Computer cassettes**  
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Were \$2.49  
Now  
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Cat X-3502



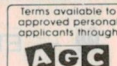
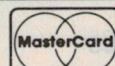
*Dick Smith Electronics Pty Ltd*

**COMPUTERSTOP**



See page 45 for address details

B000B



# CMOS portable computer

Tandy Australia Ltd has released a second generation portable computer with a 16-line 40 character LCD display and six built-in programs, including Multiplan.

Called the Tandy 200, the new computer has expanded on the built-in software and convenient features of earlier portables. It includes an improved version of the Model 100's "instant on" word processing program, and two personal management programs to help keep track of appointments, addresses and telephone numbers. The built-in communications program can give access to national information services.

The 16-line by 40 character flip-up screen features bright, clear text and sharp dot-matrix graphics.

The Tandy 200 comes standard with a 24K memory and ex-

pands to 72K by installing two additional banks of 24K, each addressed separately. It also has a new clock and 24-hour alarm.

Other features include built-in interfaces for parallel printer, cassette and bar code reader, and a full size typewriter keyboard with improved cursor control key placement and eight function keys for one touch operations.

The recommended retail price of the Tandy 200 is \$1399. The company will also continue to market the earlier Model 100, which has become one of the world's biggest selling lap computers.



## Compatible PC

An extensive range of features and competitive pricing are claimed by Toshiba for its new desktop and portable IBM-compatible personal computers.

The desktop model is the

Toshiba T1500. The portable is the Toshiba model T1100.

Based on an Intel 8088 processor and the MS-DOS operating system, the T1500 can be set up in two possible configura-

tions, one with dual floppy disk drives (System FF) and the other with a single floppy disk drive and a hard disk drive (System FH). The formatted capacity of the half-height, double-sided, double density floppy disk drive is 320/360K bytes. Formatted capacity of the hard disk is 10.1M bytes. Both configurations of the computer have the base 128K bytes of RAM which can be expanded up to 640K additional bytes on the system board.

The T1500 has an 8K ROM containing the codes for system checking and testing as well as the basic I/O system which is claimed to be compatible with the IBM ROM BIOS.

The standard system is provided with an interface for an optional colour graphics display and a port for an optional parallel printer. (A 30 cm (12 inch) monochrome display, a 33 cm (13 inch) colour display, or a 640 x 240 pixel LCD may be connected to the T1500 for graphics.)

Expansion cards such as the hard disk drive adapter (stand-

ard for system FH), and the asynchronous communications adapter (optional) and a high resolution graphics adapter (optional) can be plugged into the horizontal expansion slots.

The T1500 is priced at \$3950 (RRP).

The portable T1100 is \$2995 (RRP) and built on low power consumption CMOS technology with a 16-bit 80C88 microprocessor. The machine has a 256K byte RAM and an integrated 720K byte 3.5 inch floppy disk.

The liquid crystal display has 80 characters by 25 lines. It features 640 by 200 pixel resolution and is adjustable from 0 to 180 degrees for desired viewing angle.

The T1100 runs for up to 8 hours under rechargeable battery power, and under battery or optional ac power it can run all the popular IBM-PC programs.

Options include an extra floppy disk drive, printer, colour display, asynch communications adapter and 300 bps modem. An extra 256K bytes of memory can be accommodated on the computer's expansion card.



The T1500 (above) and T1100 (above right). The T1500 can be used with an optional LCD screen (right).

### CLUB CALL

A **NEC User Group** has recently formed in Brisbane, meeting on the first Friday of each month. Any enquiries can be made to David Clark, 18 Provence St, MacGregor, Qld 4109. (07)343-7680.

The **Geelong Computer Club** advises that it now meets on the first and third Fridays of each month at 8 pm in the rooms of the Geelong Amateur Radio Club, Storrer St, East Geelong. Contact the club secretary, Colin Lowne on (052)55-1232.

A **Wizzard User Group** for users of Dick Smith Wizzard and Funvision computers has recently formed, operating by mail and phone. For more information, contact Barry Klein, 24 Russell St, Bulleen, Vic 3105. (03)850-7275 ah.

The **Canberra Microbee Users Group** advises that it meets on the third Tuesday of each month at 7.30 pm in the Woden Valley High School library. Its contact is Bill Horsfall, PO Box 227, Weston Creek, ACT 2611. (062) 58-3193.

## Amstrad gets a disk drive

AWA-Thorn has launched its second home computer model, the Amstrad CPC 664, essentially a CPC 464 with a built-in 3" disk system and a number of enhancements to BASIC and the operating system in order to make the most of the integrated disk system.

The CPC 664 will come with a choice of monitors and will sell from around \$800 (RRP) with the green screen, and from around \$1000 (RRP) with the

colour monitor.

Virtually all existing CPC 464 software will run on the new 664. It is also claimed that a large proportion of the existing CPM80 software base of over 5000 programs will also be suited. As well, the CPC 664 incorporates a built-in cassette interface so that existing tape-based software can be loaded.

A second disk drive is available for the CPC 664.

## Top-of-line IBM-PC

IBM Australia has introduced a new top-of-the-line personal computer with significant performance improvements on previous models.

The IBM Personal Computer AT uses advanced technology, including the high-speed Intel 80286 microprocessor, a high-capacity diskette drive and expanded fixed disk drive options. It delivers almost five times the user memory and more than twice the information storage capacity previously available on IBM-PCs and, in most cases, system performance is two or three times faster.

The system is compatible with most existing IBM personal computer hardware and software. It can be used as a powerful single-user system or shared by up to three users. (Because of its performance and storage capabilities, this system is suitable for use with the new IBM PC network which enables users

to link IBM PCs to share programs, information and peripheral devices.)

The IBM Personal Computer AT comes in two easily expanded models. The base model includes 256,000 characters of user memory and a new 1.2 million character high-capacity diskette drive, while the enhanced model has 512,000 characters of user memory, the 1.2 million character diskette drive and a new 20 million character fixed-disk drive. Both models have an 84 key keyboard and eight expansion slots for additional features, devices and memory. Both also can be expanded with options to three million characters of user memory and up to 41.2 million characters of disk storage.

The recommended retail price is \$7821 for the base model and \$11,256 for the enhanced version.

### BRIEFS

#### Macintosh Jet printers

Hewlett-Packard's ThinkJet and LaserJet personal printers can now be made compatible with the Macintosh personal computer by using two new software packages. HP has also released the ThinkJet personal printer with an RS232C interface for Apple 11c and IBM PCjr units.

#### Touch sensitive screen

The Fluke Model 1780A Infotouch Display has a touch sensitive screen that can replace a normal keyboard. Sixty fingertip sized areas detect which part of the screen is touched. Features include a set of 96 ASCII characters plus 11 graphics characters and 19 symbols. For more details contact Elmeasco Instruments, 15 McDonald St, Mortlake, NSW 2137.

#### Teac drive 1" high

Teac's FD-135 series 3.5" micro floppy disk drive features low power consumption and a brushless direct drive motor for extended service life. Four models are available with memory capacities ranging from 250 KB to 1 MB. Further information is available from the Measurement and Control Division of Electrical Equipment Limited, 8 Lyon Park Rd, North Ryde, NSW 2113.

#### Labtam mouse unit

Labtam International has released its mouse unit to clients who have their own software development capabilities. The company provides all necessary software and documentation to support installation. Labtam also has a range of locally designed and manufactured computers for high performance 16-bit systems. Labtam is at 43 Malcolm Rd, Braeside, Vic 3195.

#### Personal computer help

An electronic help service enabling IBM Personal Computer users to access data base containing approximately 4000 questions and answers about the IBM PC has been launched by IBM Australia. Called Infosearch, it is available free of charge to users, through the company's new Technical Coordinator program or through a dealer.

#### RS232 smart cable

Smart Cable 817, an intelligent connector between computers and peripherals, looks at the RS232 signals from the computer and the peripheral and uses its own logic circuitry to make the right connections. It matches up all the data, handshake and control lines automatically. For more information contact Pro-Log (Australia) Pty Ltd, PO Box 1, Canterbury, Vic 3126.

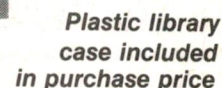
#### Low-cost PC printer

The Facit 4509 has all the features of the standard IBM PC printer but boasts a higher throughput of 60 full 80-character lines per minute. The IBM/Epson command set provides different fonts and pin graphics. For further details contact EAI-Electronic-Associates Pty Ltd, 2 George Pl, Artarmon, NSW 2064.

#### School starter kit

Ashtron Software has a budget priced school starter kit for the Apple II plus/IIe. It includes a large 318 x 318 mm touch sensitive surface mounted in a sturdy wipe-clean stressed plastic frame, PowerPad graphics tablet, Micro-Illustrator graphics software packaging and plastic stylus with interface cable. Normally \$189.95 RRP, it is now available for \$125 (school price) or \$139.95 (retail price). Ashtron is at PO Box 597, Gosford, NSW 2250.

# Nashua



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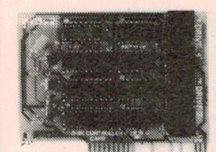
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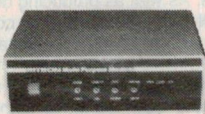
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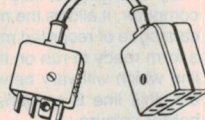
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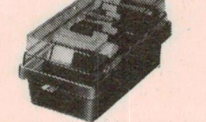


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This brand new, totally amazing kit for the Microbee is a must for all Microbee owners/users!

Most expansion units up to this time offered at best only one or other features; and this made it impossible to run, say, complex sound effects mingled with speech. The Enhancer 1 will do all this and much more as well. It is quite amazing how much has been shoe-horned into this compact unit. The Enhancer 1's many powerful features include:

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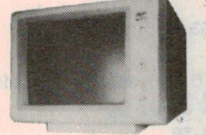


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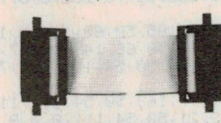
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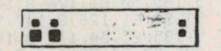
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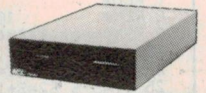
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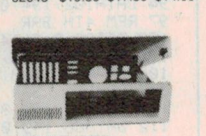
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(\*Apple is a registered trade mark.)



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Errors and omissions excepted

# COMMODORE COLUMN

## BABY ELEPHANT WALK

J. Winter, Fulham Gdns SA 5024

The Commodore 64 is renowned for its speech capabilities. As well as producing different sorts of waveform it has the capacity to control attack, sustain, decay and release. There are also various filter functions you can apply to create a vast range of sounds.

This program uses some of those facilities to play a popular ditty. Using the same methods you could create any number of sounds yourself.

The program is constructed as follows: Lines 20 to 35 set up the speech chip. Line 40 reads the data and stores it in an array. Lines 42 to 55 play the tune while the rest of the program contains the data.

## MUSIC CATALOGUE

Garry Beavan, Ryde NSW 2112

This program, while somewhat lengthy, allows the VIC-20 (or C64) to get in and perform a useful task.

By spending a little time entering data into the computer, it allows the music enthusiast to build up a catalogue of recorded music. The program is listed in a form ready to run on the VIC-20. Line 1 is the only line which will vary between (Commodore) computers, this line is responsible for setting the screen/border colours.

In its present form the computer's prompts are directed toward rock music however a word such as "GROUP" can easily be changed to "ORCHESTRA" if so desired.

The most useful function of the program is the ability to quickly recall stored information. Keep in mind when saving data to tape that you must press the RECORD button properly. Also check that you are not saving data over the top of your program!

The program will also run with a disk drive if changes are made to lines 2000, 2300, 3000, 3300. Further information can be obtained from the user manual which came with the disk drive.

For ease of reading I have removed the Commodore control characters from the listing and replaced them with abbreviations such as <C L R> which means clear screen or <C S R D> which means cursor down. When typing the program into the computer the Commodore control characters should be substituted back in.

```

3 REM*****
4 REM**      BABY ELEPHANT WALK      **
5 REM**                                          **
6 REM**      BY                        **
7 REM**                                          **
8 REM**      JOHN WINTER              **
9 REM*****
10 X=142:XC=X+1:DIMA(XC),B(XC),C(XC),D(XC),E(XC),F(XC),G(XC):I=0
20 S=54272:FORT=0T024:POKES+T,0:NEXT:P=2.05
25 S1=S+6:S2=S+13:S3=S+20:L1=S:H1=S+1:L2=S+7:H2=S+8:L3=S+14:H3=S+15
30 V=S+24:W1=S+4:W2=S+11:W3=S+18:A1=S+5:A2=S+12:A3=S+19
35 POKEA1,16+9:POKEA2,9:POKEA3,9:POKES1,14:POKES+10,4:POKES+9,20
40 FORZ=0TOX:READA(Z),B(Z),C(Z),D(Z),E(Z),F(Z),G(Z):NEXT:POKEV,15
42 FORZ=ITOX
45 POKEW1,33:POKEW2,65:POKEW3,33
50 POKEH1,A(Z):POKEL1,B(Z):POKEH2,E(Z):POKEL2,F(Z):POKEH3,C(Z):POKEL3,D(Z)
55 FORE=0TOG(Z)*P:NEXT:POKEW1,32:POKEW2,64:POKEW3,32:NEXT
60 I=9:GOTO42
68 REM 1ST BAR
70 DATA0,0,8,147,5,185,50,0,0,8,147,5,185,50,115,88,0,0,6,206,50
72 DATA115,88,0,0,7,53,50,0,0,8,147,5,185,50,0,0,8,147,5,185,50
74 DATA102,194,0,0,6,206,50,102,194,0,0,7,53,50
77 REM 2ND BAR
80 DATA0,0,8,147,5,185,50,0,0,8,147,5,185,50,0,0,6,206,50
82 DATA0,0,0,7,53,50,0,0,8,147,5,185,50,0,0,8,147,5,185,50
84 DATA0,0,0,6,206,50,0,0,0,7,53,50
87 REM 3RD BAR
90 DATA0,0,8,147,5,185,50,0,0,8,147,5,185,50,115,88,0,0,6,206,50
92 DATA115,88,0,0,7,53,50,0,0,8,147,5,185,50,0,0,8,147,5,185,50
94 DATA102,194,0,0,6,206,50,102,194,0,0,7,53,50
97 REM 4TH BAR
100 DATA0,0,8,147,5,185,50,0,0,8,147,5,185,50,0,0,6,206,50
102 DATA0,0,0,7,53,50,0,0,8,147,5,185,50,0,0,8,147,5,185,50
104 DATA0,0,0,6,206,50,0,0,0,7,53,50
107 REM 5TH BAR
110 DATA45,198,8,147,5,185,50,45,198,8,147,5,185,25,57,172,8,147,5,185,25
112 DATA68,149,0,0,6,206,50,91,140,0,0,7,53,50
114 DATA115,88,8,147,5,185,50,102,194,0,0,7,53,50
116 DATA91,140,0,0,6,206,50,76,252,0,0,7,53,50
118 REM 6TH BAR
120 DATA64,188,8,147,5,185,50,68,149,8,147,5,185,50,0,0,6,206,50
122 DATA0,0,0,7,53,50,0,0,8,147,5,185,50,0,0,8,147,5,185,50
124 DATA0,0,0,6,206,50,0,0,0,7,53,50
127 REM 7TH BAR
130 DATA45,198,8,147,5,185,50,45,198,8,147,5,185,25,57,172,8,147,5,185,25
132 DATA68,149,0,0,6,206,50,91,140,0,0,7,53,50
134 DATA115,88,8,147,5,185,50,102,194,0,0,7,53,50
136 DATA91,140,0,0,6,206,50,76,252,0,0,7,53,50
138 REM 8TH BAR
140 DATA68,149,8,147,5,185,50,68,149,8,147,5,185,50,68,149,0,0,6,206,50
142 DATA68,149,0,0,7,53,50,68,149,8,147,5,185,50,68,149,8,147,5,185,50
144 DATA76,252,0,0,6,206,50,54,111,0,0,7,53,50
147 REM 9TH BAR
150 DATA54,111,11,114,7,163,50,54,111,11,114,7,163,50
152 DATA54,111,0,0,9,21,50,54,111,0,0,9,159,50
154 DATA54,111,11,114,7,163,50,54,111,11,114,7,163,50
156 DATA54,111,0,0,9,21,50,76,252,0,0,9,159,50
158 REM 10TH BAR
160 DATA54,111,11,114,7,163,50,45,198,11,114,7,163,50
162 DATA0,0,0,9,21,50,0,0,0,9,159,50
164 DATA0,0,11,114,7,163,50,0,0,11,114,7,163,50
166 DATA0,0,0,9,21,50,0,0,0,9,159,50
168 REM 11TH BAR
170 DATA45,198,8,147,5,185,50,45,198,8,147,5,185,25,57,172,8,147,5,185,25
172 DATA68,149,0,0,6,206,50,91,140,0,0,7,53,50
174 DATA115,88,8,147,5,185,50,102,194,0,0,7,53,50
176 DATA91,140,0,0,6,206,50,76,252,0,0,7,53,50
177 REM 12TH BAR
180 DATA64,188,8,147,5,185,50,68,149,8,147,5,185,50,0,0,6,206,50
182 DATA0,0,0,7,53,50,0,0,8,147,5,185,50,0,0,8,147,5,185,50
184 DATA0,0,0,6,206,50,0,0,0,7,53,50
187 REM 13TH BAR
190 DATA102,194,12,216,8,147,50,102,194,12,216,8,147,50
192 DATA102,194,0,0,10,60,50,102,194,0,0,10,205,50
194 DATA86,105,12,216,8,147,50,68,149,12,216,8,147,50
196 DATA0,0,0,9,21,50,68,149,0,0,9,159,50
198 REM 14TH BAR
200 DATA91,140,11,114,7,163,50,91,140,11,114,7,163,50
202 DATA91,140,0,0,9,21,50,91,140,0,0,9,159,50
204 DATA81,161,11,114,7,163,25,91,140,11,114,7,163,25,81,161,11,114,7,163,25
206 DATA68,149,11,114,7,163,25,61,126,0,0,9,21,50,54,111,0,0,9,159,50
208 REM 15TH BAR
210 DATA61,126,8,147,5,185,50,61,126,8,147,5,185,50,61,126,0,0,6,206,50
212 DATA61,126,0,0,7,53,50,61,126,8,147,5,185,25,64,188,8,147,5,185,25
214 DATA61,126,8,147,5,185,25,54,111,0,0,7,53,50
216 DATA45,198,0,0,6,206,50,34,75,0,0,7,53,50
217 REM 16TH BAR
220 DATA40,200,8,147,5,185,50,45,198,8,147,5,185,50
222 DATA0,0,11,114,7,163,50,0,0,11,114,7,163,50,0,0,10,205,7,53,50
224 DATA0,0,10,205,7,53,50,0,0,9,159,6,108,50,0,0,9,159,6,108,50
226 REM 17TH BAR
230 DATA28,214,8,147,5,185,50,0,0,8,147,5,185,50,115,88,0,0,6,206,50
232 DATA115,88,0,0,7,53,50,0,0,8,147,5,185,50,0,0,8,147,5,185,50
234 DATA102,194,0,0,6,206,50,102,194,0,0,7,53,50

```

## CONTRIBUTORS PLEASE NOTE

All contributions to this column should be accompanied by a listing of the program from a printer. Hand written or typed listings are not acceptable.

There are two reasons for this. The first is that a listing from your computer gives us some guarantee that you have got the listing correct.

Secondly, if you present us with a neat final copy of your program we can use photographic techniques to reproduce it in the magazine, without risk of errors.

Contributors will be paid \$20 for each item published in this column. Submissions must be original programs which have not been previously published. You may send as many programs as you wish with the accompanying declaration.

"I agree to the above terms and grant *Electronics Today International* all rights to publish my program in ETI Magazine or other publications produced by it. I declare that the attached program is my own original material, that it has not previously been published and that its publication does not violate any other copyright."

\* Breach of copyright is now a criminal offence.

Name .....

Signature ..... Date .....

Address .....

Postcode .....

```

1 POKE36879,8 :PRINT"<YEL>"
2 H$="<CSRD><YEL>TAPE & CUE#:<CYN>":I$="<YEL>"
3 SONG NAME:<CYN>:J$="<YEL>GROUP NAME:<CYN>"
4 REM**MUSIFILE**
5 REM**G.BEAVAN
6 REM**C02J884330
10 PRINT"<CLR>"
20 DIMA$(500),B$(500),C$(500)
30 PRINT" MUSIC FILE":PRINT:PRINT
40 PRINT"THIS PROGRAM USES FIVECOMMANDS"
50 PRINT:PRINT" L A I S T C"
60 PRINT" E E E E E"
70 PRINT" L=LIST OF GROUPS"
80 PRINT" A=ADD TO THE LIST"
90 PRINT" I=INDIVIDUAL SUBJECT"
100 PRINT" S=SAVE THE LIST"
110 PRINT" T=TAKE TAPED INFO."
115 PRINT" C=CORRECTION"
120 PRINT"<CSRD><CSRD><CSRR><CSRR>COMMAND?"
121 GETZ$:IFZ$="":THEN121
130 IFZ$="L"THENPRINT"<CLR>":GOTO200
140 IFZ$="A"THENPRINT"<CLR>":GOTO400
150 IFZ$="I"THENPRINT"<CLR>":GOTO1000
160 IFZ$="S"THENPRINT"<CLR>":GOTO2000
170 IFZ$="T"THENPRINT"<CLR>":GOTO3000
175 IFZ$="C"THENPRINT"<CLR>":GOTO4000
180 PRINT"<CLR>":GOTO400
200 FORA=1TO500
210 IFC$(A)="*/"THEN240
215 IFC$(A)="":THEN240
220 PRINT C$(A);":":
230 NEXTA
240 PRINT:PRINT"<CSRD>THAT'S ALL OF THEM"
250 PRINT:PRINT
260 GOTO120
400 FORD=1TO500
410 IFA$(D)="":THEN450
420 NEXTD
450 FORB=1TO500
455 PRINT
460 INPUT"TAPE & CUE#":A$(B)
470 INPUT"SONG NAME":B$(B)
480 INPUT"GROUP NAME":C$(B)
490 PRINT:PRINT:HIT M FOR MENU"
500 GETX$:IFX$="":THEN500
510 IFX$="M"THENPRINT"<CLR>":GOTO50
520 NEXTB
1000 PRINT"<CSRD><YEL>TAPE,SONG,GROUP OR MENU"
1005 GETY$:IFY$="":THEN1005
1006 PRINT"<CLR>"
1010 IFY$="T"THEN1050
1020 IFY$="S"THEN1200
1030 IFY$="G"THEN1300
1035 IFY$="M"THEN70
1040 GOTO1000
1045 REM**SELE TAPE POSITION
1050 INPUT"TAPE & CUE#":A$
1060 FORB=1TO500
1061 JJ=0
1070 IFLEFT$(A$(B),6)=LEFT$(A$,6)THENJJ=1

```

```

1075 IFJJ=1THENPRINTH$;A$(B):PRINTI$;B$(B):PRINTJ$;C$(B):GOTO1000
1080 NEXTB
1090 PRINT:PRINT"<YEL>SORRY,NOTHING AT THAT POSITION":PRINT
1100 GOTO1000
1110 REM**FIND SONG
1200 INPUT"NAME OF SONG":A$
1210 FORB=1TO500
1215 JJ=0
1220 IFLEFT$(B$(B),6)=LEFT$(A$,6)THENJJ=1
1225 IFJJ=1THENPRINTH$;A$(B):PRINTI$;B$(B):PRINTJ$;C$(B):GOTO1000
1230 NEXTB
1240 PRINT:PRINT"<CSRD><YEL>NOTHING OF THAT NAME":PRINT
1250 GOTO1000
1290 REM**FIND GROUP
1300 INPUT"NAME OF GROUP":A$
1310 FORB=1TO500
1315 JJ=0
1320 IFLEFT$(C$(B),6)=LEFT$(A$,6)THENJJ=1
1325 IFJJ=1THENPRINTH$;A$(B):PRINTI$;B$(B):PRINTJ$;C$(B):F=1
1330 NEXTB
1340 IFF=1THENPRINT"<YEL>THAT'S ALL I KNOW":F=0:GOTO1000
1350 JJ=0
1360 PRINT"CHECK YOUR SPELLING"
1370 GOTO1000
1990 REM**SAVE LIST
2000 OPEN1,1,1,"MUSIFILE"
2010 PRINT"<CLR><CSRD><CSRD>SAVING!"
2020 FORB=1TO500
2030 A$=A$(B)
2040 IFA$="":THENPRINT#1,"*":GOTO2100
2050 PRINT#1,A$
2060 NEXTB
2100 FORB=1TO500
2120 A$=B$(B)
2130 IFA$="":THENPRINT#1,"*":GOTO2200
2140 PRINT#1,A$
2150 NEXTB
2200 FORB=1TO500
2210 A$=C$(B)
2220 IFA$="":THENPRINT#1,"*":GOTO2300
2230 PRINT#1,A$
2240 NEXTB
2300 CLOSE1
2310 GOTO70
2990 REM**GET INFO.
3000 OPEN1,1,0,"MUSIFILE":PRINT"FOUND INFORMATION"
3010 FORB=1TO500
3020 INPUT#1,A$
3030 IFA$="*/"THENA$(B)="":GOTO3100
3040 A$(B)=A$
3050 NEXTB
3100 FORB=1TO500
3110 INPUT#1,A$
3120 IFA$="*/"THENB$(B)="":GOTO3200
3130 B$(B)=A$
3140 NEXTB
3200 FORB=1TO500
3210 INPUT#1,A$
3220 IFA$="*/"THENC$(B)="":GOTO3300
3230 C$(B)=A$
3240 NEXTB
3300 CLOSE1
3310 GOTO120
4000 PRINT"EVERY TIME YOU HIT THESPACE BAR I WILL PRINTTHE NEXT";
4001 PRINT" ENTRY ALONG WITH IT'S NUMBER. "
4010 PRINT"WHEN YOU SEE A MISTAKEHIT S AND I WILL STOP."
4015 PRINT"<CSRD><CSRD><CSRD>HIT SPACE"
4020 G=0
4024 PRINT"<YEL>"
4025 GETK$:IFK$="":THEN4025
4026 IFK$="S"THEN4100
4027 G=G+1
4028 IFG=500THEN70
4030 PRINT"<RVSON>#";G;"<RVSOFF>":PRINTH$;A$(G)
4040 PRINTI$;B$(G)
4050 PRINTJ$;C$(G)
4060 GOTO4024
4100 PRINT" TAPE,SONG,GROUP OR MENU"
4110 GETK$:IFK$="":THEN4110
4120 IFK$="T"THEN4200
4130 IFK$="S"THEN4300
4140 IFK$="G"THEN4400
4150 IFK$="M"THENPRINT"<CLR>":GOTO70
4160 GOTO4100
4200 INPUT# TO CORRECT";G
4205 PRINTA$(G)
4210 INPUT"CHANGE TO";AA$
4220 IFAA$="":THENA$(G)=AA$
4230 GOTO4100
4300 INPUT# TO CORRECT";G
4305 PRINTB$(G)
4310 INPUT"CHANGE TO";BB$
4320 IFBB$="":THENB$(G)=BB$
4330 GOTO4100
4400 INPUT# TO CORRECT";G
4405 PRINTC$(G)
4410 INPUT"CHANGE TO";CC$
4420 IFCC$="":THENC$(G)=CC$
4430 GOTO4100

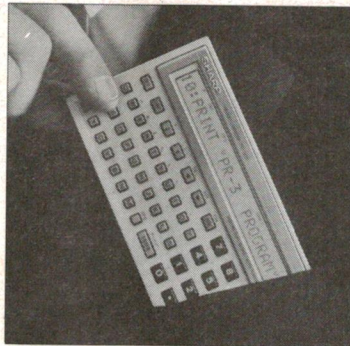
```

# Help is at hand with a Sharp pocket computer.

## PC1251

4.2K byte RAM.  
24K byte ROM.  
24 digit LCD.  
Options - Cassette interface, Printer and Cassette interface, Printer and Microcassette, Software tapes. Also available a range of pre-programmed software tapes.

**\$180\*.**

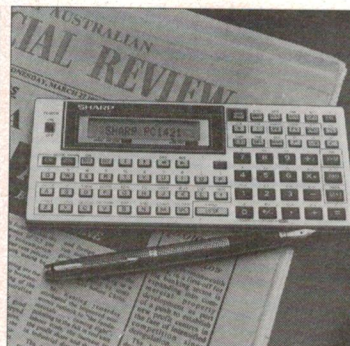


## PC1421

**Financial computing**  
4.2K byte RAM.  
40K byte ROM. 16 digit LCD.  
Operate as computer or financial calculator.  
Built-in business/financial functions. Including compound interest, cash flow analysis, selling price and margin calculations.  
Options - Cassette interface, Printer and Cassette interface.

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**NEW!**

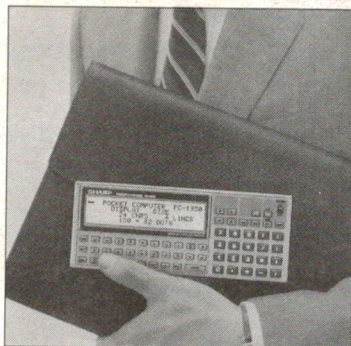


## PC1350

5K byte RAM expandable to 21K byte.  
40K byte ROM.  
24 digit by 4 line text or 150 by 32 dot graphic LCD.  
Built-in RS232C interface.  
Options - Cassette interface, Printer and Cassette interface, 8K or 16K byte RAM expansion card.

**\$265\*.**

**NEW!**



## PC1500A

8.5K byte RAM expandable to 24.5K byte.  
16K byte ROM.  
26 digit text or 156 x 7 dot graphic LCD.  
Options - 4 colour printer/plotter and cassette interface, RS232C and Centronics standard interface, 8K byte programmable RAM module, 8K or 16K byte programmable RAM module battery supported plus technical reference manual.

**\$315\*.**



## PC1401

**Scientific computing**  
4.2K byte RAM.  
40K byte ROM.  
16 digit LCD.  
Operate as computer or scientific calculator.  
59 scientific functions.  
Options - Cassette interface, Printer and Cassette interface.

**\$195\*.**

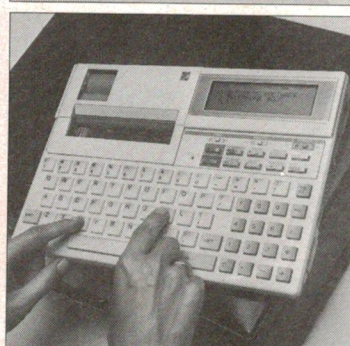


## PC2500

5K byte RAM expandable to 21K byte. 72K byte ROM.  
24 digit by 4 line text or 150 by 32 dot graphic LCD.  
Built-in 4 colour printer/plotter, cassette interface, and RS232C interface.  
Built-in business software.  
Typewriter keyboard.  
Options - 8K byte or 16K RAM expansion card.

**\$545\*.**

**NEW!**

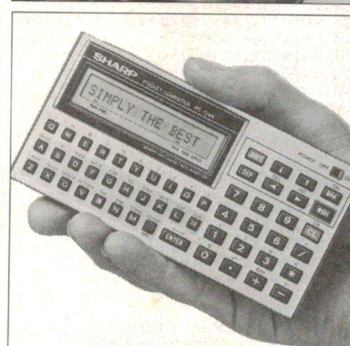


## PC1246

2K byte RAM.  
17K byte ROM.  
16 digit LCD.  
Options - Cassette interface, Printer and Cassette interface, Printer and Microcassette.

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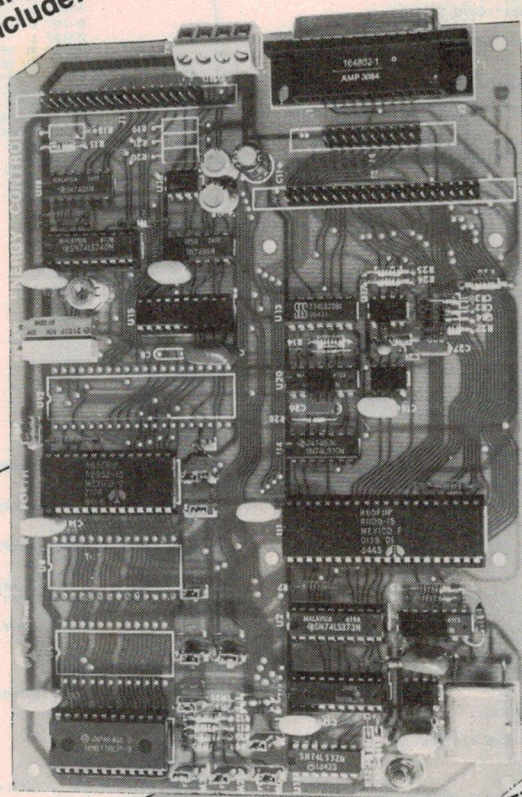
- (i) Low cost development system mains DS board, plated through holes and silkscreen as seen on page 72 of ETI May, 1985.
- (ii) The complete RSC Forth manual.
- (iii) R65F11 Forth Kernel and Microcomputer.
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(ii) R6512 processor for increased I/O capability.

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## Combat Battle Game

S. L. Robjohns, Somerton Park SA 5044

This program has been designed for use with Microworld Basic. It shows PCG graphics without needing machine code programming.

The object of the game is to win the battle between air and ground forces. The player controls the ground force while the Microbee controls the air force. The ground force is equipped with a tank which fires vertically into the air. The keys controlling this tank are: '<' to move left; '>' to move right; and 'X' to fire gun.

The air force consists of aircraft

which can drop bombs and men via parachutes. These aircraft can be destroyed outright by a direct hit or they can be damaged, allowing the people inside to escape. When three such people reach the ground they are able to construct an anti-tank gun which can destroy the tank.

The method of scoring is as follows: 1 point for a direct hit on the aircraft, 1 point for a tank being destroyed by a bomb, and 1 point for a tank being destroyed by the gun. The first force to reach 10 points is the winner.

```
00100 REM      COMBAT - a battle game for the microbee
00110 REM      S.L. Robjohns      July 1984
00120 CLS:GOSUB 700
00130 J=0:K=0:L=0
00140 CLS:PCG:FOR Z=832 TO 895:CURSZ:PRINT"K":NEXT Z:NORMAL
00150 CURS96:PRINT"Air Force Score : "JK:CURS942:PRINT"Army Score : "JL
00160 REM      Movement of Tank
00170 IF L=10 OR K=10 THEN 630 ELSE PCG
00180 A=INT(RND*50)+770:B=INT(RND*40)+74:B1=F1:I=1
00190 S0$=KEY$:IF S0$="<" THEN CURSA:PRINT"l:nnopt":GOTO 310
00200 IF S0$=">" AND S0$="X" THEN 220
00210 IF A<770 THEN LET B=0:GOTO 240 ELSE LET B=-1:GOTO 240
00220 IF S0$="X" AND S0$="X" THEN 250
00230 IF A<821 THEN LET B=0 ELSE LET B=1
00240 A=A+B:CURSA:PRINT"l:nnopt":IF I=2 THEN 520 ELSE 310
00250 IF I=2 THEN 520 ELSE LET B=0:C=A-700
00260 IF S0$="X" OR S0$="X" THEN CURSC:PRINT"q$":OUT 2,64:OUT 2,0 ELSE 190
00270 FOR Z=1 TO 20 :NEXT Z:CURSZ:PRINT"tlt"
00280 IF C<D+1 AND C<D+2 THEN 500 ELSE CURSD:PRINT"tlttlt":PLAY 13:PLAY 0
00290 NORMAL:L=L+1:CURS956:PRINT L:IF L=10 OR K=10 THEN 630
00300 REM      Movement of Plane
00310 PCG:R1=RND*3:CURSD:PRINT"tlttlt"
00320 IF R1<1 THEN LET E=INT(RND*5) :GOTO 340
00330 IF R1<2 THEN LET E=INT(RND*5)
00340 IF D<70 THEN LET E=5:GOTO 360
00350 IF D116 THEN LET E=5
00360 D=D+E:CURSD:PRINT"abcdb"
00370 REM      Bomb Drop
00380 IF F11 THEN 480
00390 IF F=11 THEN LET G=D+2
00400 IF G=64 AND G<127 THEN CURSG*64:PRINT"j":G=G+64:GOTO 480
00410 CURSG:PRINT"t":CURSG*64:PRINT"j"
00420 IF G=704 AND G<767 THEN 430 ELSE LET G=G+64:GOTO 480
00430 IF G=A-64 AND G<A-58 THEN 440 ELSE 470
00440 CURSA:PRINT"tltq$":PLAY 1,4:CURSA:PRINT"tlttlt":CURSA*2:PRINT"xy"
00450 PLAY 0,1:CURSA*2:PRINT"t":NORMAL
00460 K=K+1:CURS914:PRINT K:FOR Z=64 TO 127:CURSZ:PRINT" " :NEXT Z:GOTO 170
00470 CURSG*63:PRINT"q$":FOR Z=1 TO 20:NEXT Z:CURSG*63:PRINT"tlt":F=1:GOTO 190
00480 F=F+1:FOR Z=1 TO 5:NEXT Z:GOTO 190
00490 REM      Parachute Drop
00500 IF C<D-1 AND C<D AND C<D+3 AND C<D+4 THEN 190
00510 CURSD:PRINT"tlttlt":H=D+2
00520 CURSH*64:PRINT"tlt":CURSH:PRINT"gh":CURSH*65:PRINT"i":PLAY 0:H=H+64:I=2
00530 IF H<768 THEN LET S0$=KEY$:GOTO 200
00540 REM      Building Anti-Tank Gun
00550 CURSH*64:PRINT"tlt":I=1:PLAY 0,2:CURSH*1:PRINT"t":J=J+1
00560 IF J=1 THEN CURS830:PRINT" " :GOTO 310
00570 IF J=2 THEN CURS829:PRINT"u":GOTO 310
00580 CURS831:PRINT"i":CURSG:PRINT"t":PLAY 0,5
00590 CURSA:PRINT"tlttlt":CURSA*1:PRINT"q$"
00600 FOR Z=1 TO 20:OUT 2,64:OUT 2,0:FOR Y=1 TO 50:NEXT Y:NEXT Z
00610 CURSA:PRINT"tlttlt":CURSA*1:PRINT"xy":PLAY 0,10:NORMAL
00620 K=K+1:CURS914:PRINT K:FOR Z=768 TO 831:CURSZ:PRINT" " :NEXT Z:J=0:GOTO 170
00630 IF K=10 THEN CURS921:PRINT" * AIR FORCE WINS *":GOTO 650
00640 CURS921:PRINT" * ARMY WINS *"
00650 PLAY 0,15:CURS18,6:PRINT"Would you like another game ?"
00660 G4$=KEY$:IF G4$="Y" THEN 660
00670 IF G4$="Y" OR G4$="Y" THEN 130
00680 IF G4$="N" AND G4$="N" THEN 660 ELSE CLS:END
00690 REM      Storing PCG Characters
00700 P=63488*97*16:FOR Z=P TO P+16*25-1:READ A:POKE Z,A:NEXT Z
00710 DATA 0,0,0,0,0,0,0,255,63,0,0,0,0,0,0,0,0
00720 DATA 0,0,0,0,0,0,0,255,255,24,24,0,0,0,0,0,0
00730 DATA 1,1,15,1,3,15,25,249,255,31,15,3,0,0,0,0,0
00740 DATA 128,128,240,128,192,240,152,159,255,248,240,192,0,0,0,0,0
00750 DATA 0,0,0,0,0,0,0,255,252,0,0,0,0,0,0,0,0
00760 DATA 0,0,0,0,0,0,0,7,31,127,255,0,0,0,0,0,0
00770 DATA 0,0,0,0,0,255,255,255,255,255,0,0,0,0,0,0
00780 DATA 0,0,0,0,0,0,224,248,254,255,0,0,0,0,0,0
00790 DATA 0,0,0,0,0,60,60,24,255,189,189,189,36,36,231
00800 DATA 0,0,0,231,126,60,24,24,60,60,60,60,24,0,0,0,0
00810 DATA 0,255,255,0,0,0,0,0,0,0,0,0,0,0,0,0,0
00820 DATA 0,0,0,0,0,0,0,1,3,7,255,255,255,224,192
00830 DATA 0,0,0,0,0,0,1,3,7,255,255,255,255,224,192
00840 DATA 0,0,24,24,24,24,24,255,255,255,255,255,255,0,0
00850 DATA 0,0,0,0,0,0,0,128,192,224,255,255,255,255,7,3
00860 DATA 0,0,0,0,0,0,0,0,0,254,255,255,255,224,192
00870 DATA 0,0,192,48,12,3,0,255,255,0,192,48,12,3,0,0
00880 DATA 24,24,24,24,24,24,219,255,255,219,24,24,24,24,24
00890 DATA 0,0,3,12,48,192,0,255,255,0,192,48,12,3,0,0
00900 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
00910 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
00920 DATA 0,0,0,15,30,60,120,248,248,248,248,252,254,255,255
00930 DATA 0,0,0,0,0,0,0,0,0,3,3,63,255,255,255,255
00940 DATA 0,0,0,0,0,0,0,0,0,240,248,248,254,255,255,255
00950 DATA 0,0,0,0,0,0,0,0,0,4,12,30,255,255,255,255
00960 RETURN
```

## STAR DRIVER

David Hughes, Howrah, Tas 7108

This program is a modification of one shown in ETI Feb '84 by Geoffrey Tyerman. Mr Tyerman's program was written specifically for an Epson or Epson compatible printer. This one adopts the ideas presented there to a Star Gemini 10x printer.

The problem is that Mr Tyerman's program will not run in the double density mode as it will not return after printing the top half of the line. To cure this carriage returns have been added. This program has the ability to do single, double and quadruple density graphics. It can also do double density, double speed graphics.

It is called from a BASIC program by putting the assembly address into C2 and C3. When assembled at 7A00H, you input POKE 194,0: POKE 195,122. When you want to dump to the printer you use the ESC key. Then the S,D and Q keys may be used for calling single, double and quadruple density graphics. T gives you double speed. Each mode can be called by the use of USR, just so long as the JP instruction at the end of the program is changed to a RETURN.

This program does not destroy any registers.

ADDR	CODE	LINE	LABEL	MNEM	OPERAND
00100					
00110					HIRES HORIZONTAL PRINTER SCREEN DUMP
00120					
00130					FOR STAR GEMINI 10X
00140					
00150					
00160					
00170	HL OFF				
00180	HL ON				
00190	CURR1	EQU	10H		itop part of line counter
00200	CURR2	EQU	12H		ibottom part of line counter
00210	LINE	EQU	14H		iline counter
00220	TOPBOT	EQU	15H		itop or bottom part of line
00230	CHARCT	EQU	16H		icharacter counter
00240	CHAR	EQU	40H		
00250	DOT	EQU	17H		icurrent dot/column in char
00260	DATA	EQU	18H		ipcg/rom location data storage
00270	MODE	EQU	1AH		imode - single or double density
00280	TONE	EQU	43682		
7A00	ORG		7A00H		
7A00	E5	00300			
7A01	F5	00310			isave registers
7A02	C5	00320			
7A03	D5	00330			
7A04	3A0D01	00340			
7A07	FE00	00350			
7A09	CA9D7B	00360			
7A0C	CD0680	00370			
7A0F	FE44	00380			
7A11	2B13	00390			
7A13	FES3	00400			
7A15	2B0B	00410			
7A17	FES4	00420			
7A19	2B0F	00430			
7A1B	FES1	00440			
7A1D	2B0F	00450			
7A1F	C39D7B	00460			
00470					
00480	SINDEN	LD	A,0		
00490					
00500					
00510	DOUDEN	LD	A,1		
00520					
00530					
00540	DDSDPD	LD	A,2		
00550					
00560					
00570	QUADEN	LD	A,3		
00580	START	LD	(MODE),A		ld 'A' with mode 0,1,2or3
00590					
00600	initialise routine				
7A33	CDA2AA	00610			
7A36	216B7B	00620			
7A39	CD7C7B	00630			
00640					
7A3C	2100F0	00650	INITAL	LD	HL,0F000H ;start of dump location
7A3F	221000	00660		LD	(CURR1),HL ; ( screen )
7A42	221200	00670		LD	(CURR2),HL
7A45	3E10	00680		LD	A,10H ;no. of lines
7A47	321400	00690		LD	(LINE),A
7A4A	3E00	00700		LD	A,0
7A4C	321500	00710		LD	(TOPBOT),A ;init topbot to top
7A4F	21617B	00720	INITLF	LD	HL,LF ;init. printer LF to 16/244"
7A52	CD7C7B	00730		CALL	PRINTR ;routine to send data to pri
7A55					
7A58	2E40	00740	LINSTR	LD	A,CHAR ;no. CHAR per line
7A57	321600	00750		LD	(CHARCT),A ;bits per char 0-7
7A5A	3E07	00760		LD	A,7
7A5C	217000	00770		LD	(DOT),A
7A5F	3A1A00	00780		LD	A,(MODE) ;ld 'A' with mode
7A62	FE00	00790		CP	0
7A64	2B0D	00800		CP	1
7A66	FE01	00810		CP	2
7A68	2B13	00820		CP	2
7A6A	FE02	00830		CP	2
7A6C	2B0A	00840		CP	2
7A6E	21727B	00850	QUADD	LD	HL,QFG ;double density double speed
7A71	180D	00860		LD	HL,QFG ;must be quadruple density
7A73	21657B	00870	SINGLE	LD	HL,SGD ;load data for single density
7A76	1B08	00880		LD	CONTI
7A78	216D7B	00890	DDSP	LD	HL,DSP ;load data for ddsp
7A7B	1B03	00900		LD	CONTI
7A7D	21777B	00910	DOUB	LD	HL,DD ;load data for double density
7A80	CD7C7B	00920	CONTI	CALL	PRINTR ;do it!
00930					
00940					
00950	ifind char at current line				
7A83	211500	00950	FINDCH	LD	HL,TOPBOT
7A86	CB46	00960		BIT	0,(HL)
7A8B	2B05	00970		JR	2,TFLNCH ;top line char.

```

ADDR CODE LINE LABEL MNEM OPERAND

7ABA 2A1200 00980 LD HL,(CURR2)
7ABD 1803 00990 JR LDA
7ABF 2A1000 01000 TPLNCH LD HL,(CURR1)
7A92 7E 01010 LDA LD A,(HL) ;current char in 'A'
01020 ;
01030 ; find data for char (pcg)
01040 ;
7A93 0604 01050 FINDDT LD B,4
7A95 5F 01060 LD E,A
7A96 1600 01070 LD D,0 ;load de with a
7A98 B1 01080 OR C ;clear carry
7A99 CB13 01090 ROTATE RL E
7A9B CB12 01100 RL D
7A9D 10FA 01110 DJNZ ROTATE ;rotate 4 times
7A9F 2100F0 01120 LD HL,OF000H
7AA2 19 01130 ADD HL,DE ;add to find char data loc.
7AA3 221800 01140 LD (DATA),HL
01150 ;
01160 ;find print data
01170 ;
7AA6 211500 01180 FINDFD LD HL,TOPBOT
7AA9 0608 01190 LD B,8
7AAB CB46 01200 BIT 0,(HL)
7AAD 2A1800 01210 LD HL,(DATA)
7AB0 2804 01220 JR Z,PNDT
7AB2 110800 01230 LD DE,8
7AB5 19 01240 ADD HL,DE ;find data for sec line
7AB6 3E01 01250 PNDT LD A,1
7ABB D30B 01260 OUT (0BH),A ;latch char rom.
7ABA 1800 01270 LOFE LD E,0
7ABC CD297B 01280 LOFBIT CALL TSTBIT ;test current bit & ret
7ABF 2003 01290 JR NZ,ISSET ;bit is set
7AC1 B1 01300 OR C ;clear carry
7AC2 1801 01310 JR MOVCRY
7AC4 37 01320 ISSET SCF ;set carry flag as bit is
7AC5 CB13 01330 MOVCRY LD A,0 ;move data from carry - 'E'
7AC7 23 01340 INC HL ;move to next data locatn
7ACB 10F2 01350 DJNZ LOFBIT
01360 ;data for printis stored in 'E'
7ACA 7B 01370 LD A,E ;load 'A' with 'E'
7ACB CD45B0 01380 CALL B045H ;basic rom printer routine
7ACE 3E00 01390 LD A,0 ;reset character rom so
7AD0 D30B 01400 OUT (0BH),A ;program can read screen
01410 ;routine to check that all data
01420 ;been generated. If so move onto next.
7AD2 3A1700 01430 DONEB LD A,(DOT) ;ld 'A' with curr column
7AD5 3D 01440 DEC A ;move to next dot/column
7AD6 321700 01450 LD (DOT),A
7AD9 FEFF 01460 CP OFFH ;test for finish
7ADB 20C9 01470 JR NZ,FINDPD ;if not finished - FINDPD
7ADD 3E07 01480 LD A,7 ;column fin. Reset column
7ADF 321700 01490 LD (DOT),A ; to seven
01500 ;
01510 ;do next char in line
01520 ;
7AE2 3A1600 01530 NXTCHR LD A,(CHARCT) ;ld 'A' with char counter
7AE5 3D 01540 DEC A
7AE6 321600 01550 LD (CHARCT),A
7AE9 FE00 01560 CP 0 ;test for 1 line done
7AEB F5 01570 PUSH AF ;save result on stack
7AEC 211500 01580 LD HL,TOPBOT
7AEF CB46 01590 BIT 0,(HL) ;test for top/bot line
7AF1 2016 01600 JR NZ,BOTELN
7AF3 2A1000 01610 LD HL,(CURR1) ;ld 'HL' with curr top
7AF6 23 01620 INC HL
7AF7 221000 01630 LD (CURR1),HL
7AFA F1 01640 AF ;pop result of previous test
7AFB CB837A 01650 JP NZ,FINDCH ;if not at end of line
7AFC DB867B 01660 CALL RETURN
7B01 3E01 01670 LD A,1 ;if at end of line set
7B03 321500 01680 LD (TOPBOT),A ; currentline to bottom.
7B06 C3557A 01690 JP LINSTR ;continue on bottom line
7B09 2A1200 01700 BOTELN LD HL,(CURR2) ;ld 'HL' with bottom line
7B0C 23 01710 INC HL ;next char
7B0D 221200 01720 LD (CURR2),HL
7B10 F1 01730 POP AF ;pop result of test
7B11 CB837A 01740 JP NZ,FINDCH ;if not fin. goto FINDCH
7B14 3E00 01750 LD A,0 ;fin. reset top/bot to
7B16 321500 01760 LD (TOPBOT),A ;top
7B19 3A1400 01770 LD A,(LINE) ;load 'A' with no. of
7B1C 3D 01780 DEC A ;screen lines left and
7B1D 321400 01790 LD (LINE),A ;dec by one
7B20 DB867B 01800 CALL RETURN
7B23 C2557A 01810 JP NZ,LINSTR ;test for no more left
7B26 C39D7B 01820 JP FINISH
01830 ;
01840 ;test for bit 'A' at location 'HL'
01850 ;
7B29 4E 01860 TSTBIT LD C,(HL) ;load data into b to test
7B2A 3A1700 01870 LD A,(DOT) ;bit to test in char
7B2D FE00 01880 CP 0
7B2F 282D 01890 JR Z,BIT0
7B31 FE01 01900 CP 1
7B33 2826 01910 JR Z,BIT1
7B35 FE02 01920 CP 2
7B37 281F 01930 JR Z,BIT2
7B39 FE03 01940 CP 3
7B3B 2818 01950 JR Z,BIT3
7B3D FE04 01960 CP 4
7B3F 2811 01970 JR Z,BIT4
7B41 FE05 01980 CP 5
7B43 280A 01990 JR Z,BIT5
7B45 FE06 02000 CP 6
7B47 2803 02010 JR Z,BIT6
7B49 CB79 02020 BIT7 BIT 7,C
7B4B C9 02030 RET
7B4C CB71 02040 BIT6 BIT 6,C
7B4E C9 02050 RET
7B4F CB69 02060 BIT5 BIT 5,C
7B51 C9 02070 RET
7B52 CB61 02080 BIT4 BIT 4,C
7B54 C9 02090 RET
7B55 CB59 02100 BIT3 BIT 3,C
7B57 C9 02110 RET
7B58 CB51 02120 BIT2 BIT 2,C
7B5A C9 02130 RET
7B5B CB49 02140 BIT1 BIT 1,C
7B5D C9 02150 RET
7B5E CB41 02160 BIT0 BIT 0,C
7B60 C9 02170 RET
02180 ;data for printer initialisation
02190 ;

```

```

ADDR CODE LINE LABEL MNEM OPERAND

7B61 1B33 02200 LF .DEFW 331BH ;ESC. 3
7B63 1000 02210 DEFW 0010H ;16 0
7B65 1B 02220 SGD DEFB 1BH ;ESC.
7B66 4B 02230 DEFB 'K' ;K single density
7B67 FF 02240 DEFB 255
7B68 01 02250 DEFB 1H
7B69 00 02260 DEFB 0
7B6A 0A 02270 RTUN DEFB 10
7B6B 0D 02280 RTN DEFB 13
7B6C 00 02290 DEFB 0
7B6D 1B 02300 DSP DEFB 1BH ;ESC
7B6E 79 02310 DEFB 'Y' ;double speed
7B6F FF 02320 DEFB 255
7B70 01 02330 DEFB 1
7B71 00 02340 DEFB 0
7B72 1B 02350 QPG DEFB 1BH ;ESC
7B73 7A 02360 DEFB 'Z' ;quad density graphics
7B74 FF 02370 DEFB 255
7B75 01 02380 DEFB 1
7B76 00 02390 DEFB 0
7B77 1B 02400 DD DEFB 1BH ;ESC.
7B78 4C 02410 DEFB 'L' ;L double density
7B79 FF 02420 DEFB 255
7B7A 01 02430 DEFB 1
7B7B 00 02440 DEFB 0
02450 ;
02460 ; OUT TO PRINTER ROUTINE
02470 ;
7B7C 7E 02480 PRINTR LD A,(HL)
7B7D 23 02490 INC HL
7B7E FE00 02500 CP 0
7B80 C9 02510 RET Z
7B81 CD45B0 02520 CALL B045H
7B84 1BF6 02530 JR PRINTR
7B86 F5 02540 RETURN PUSH AF
7B87 E5 02550 LD HL
7B88 3A1A00 02560 LD A,(MODE)
7B8B FE00 02570 CP 0
7B8D 2805 02580 JR Z,SINGLE ;no linefeed if single density
7B8F 216A7B 02590 LD HL,RTUN ;else load linefeed
7B92 1803 02600 JR PTNR ;then goto printer routine
7B94 216B7B 02610 SINGLE LD HL,RTN ;single density initial data
7B97 CD7C7B 02620 PTNR CALL FRINTR ;call printer out routine
7B9A E1 02621 POP HL
7B9B F1 02622 POP AF
7B9C C9 02623 RET
7B9D D1 02630 FINISH POP DE
7B9E C1 02640 POP BC
7B9F F1 02650 POP AF
7BA0 E1 02660 POP HL
7BA1 C3E9A3 02670 JP 41961
0000 02680 END
00000 Total errors

PTNR 7B97 SINGLE 7B9A RTUN 7B6A BIT7 7B49
BIT6 7B4C BIT5 7B4E BIT4 7B52 BIT3 7B55
BIT2 7B58 BIT1 7B5B BIT0 7B5E ENDLN 7B19
RETURN 7B8B BOTELN 7B09 NXTCHR 7AE2 DONEB 7AD2
MOVCRY 7AC5 ISSET 7AC4 TSTBIT 7B29 LOFBIT 7ABC
LOFE 7ABA PNDT 7AB6 FINDPD 7AA6 ROTATE 7A99
FINDDT 7A93 LDA 7A92 TPLNCH 7ABF FINDCH 7AB3
DD 7B77 DSP 7B6D SGD 7B65 CONTI 7AB0
DPS 7B72 QUADP 7A6E DDSP 7A7B DOUB 7AD7
SINGLE 7A73 LINSTR 7A55 LF 7B61 INITLF 7A4F
INITAL 7A3C PRINTR 7B7C RTN 7B6B START 7A30
QUADEN 7A2E DDSPD 7A2A SINDEN 7A22 DOUDEN 7A26
FINISH 7B9D TONE AAA2 MODE 001A DATA 0018
DOT 0017 CHAR 0040 CHARCT 0016 TOPBOT 0015
LINE 0014 CURR2 0012 CURR1 0010

```

## CONTRIBUTORS PLEASE NOTE

All contributions to this column should be accompanied by a listing of the program from a printer. Hand written or typed listings are not acceptable.

There are two reasons for this. The first is that a listing from your computer gives us some guarantee that you have got the listing correct.

Secondly, if you present us with a neat final copy of your program we can use photographic techniques to reproduce it in the magazine, without risk of errors.

However, if you present us with a scrawl done on the back of someone's old fag packet it needs to be manually typed twice here, with consequent increase in labour on our part and increase in the probability of errors.

Contributors will be paid \$20 for each item published in this column. Submissions must be original programs which have not been previously published. You may send as many programs as you wish with the accompanying declaration.

"I agree to the above terms and grant *Electronics Today International* all rights to publish my program in ETI Magazine or other publications produced by it. I declare that the attached program is my own original material, that it has not previously been published and that its publication does not violate any other copyright."  
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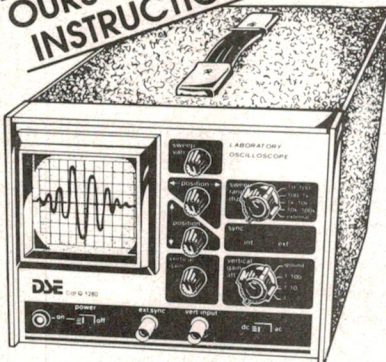
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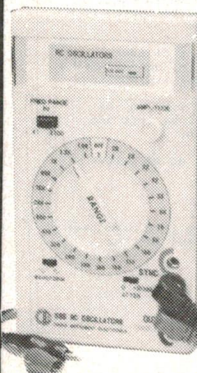
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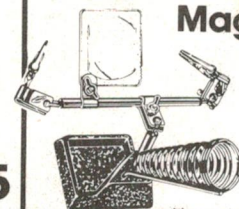
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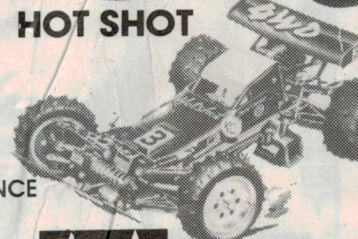
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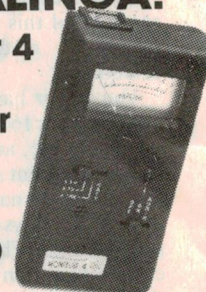
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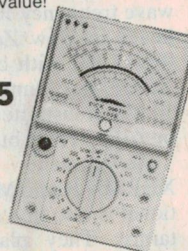
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# Shortwave stations forced to use allocated channels

Over the years stations operating on the shortwave bands particularly in Latin America, have ceased to use their allocated frequencies and reversed to mediumwave transmission, but this is about to change as governments get tough with stations, forcing them to use the appropriate channel or frequency under threat of cancelled licences.

In Mexico the government has taken this action with the realization that the World Administrative Radio Conference reconvenes in Geneva in January 1987, and each country must have decided on its own frequency broadcasting plan. In the case of Mexico, several commercial stations have shortwave frequencies allocated and none have been in regular use except the government station XERMX. Some of the stations have received this directive and according to Radio Nederland's "Media Network", have already reactivated this shortwave relay of their mediumwave programmes.

The writer has verified in the past 40 years 16 Mexican stations on shortwave, and of these only the government station XERMX has an external service. The others are relays of mediumwave programmes. The Mexican government's action is applauded by shortwave listeners, as almost all the Mexican shortwave stations have frequencies allocated which have not been used for years. The decision will mean not only in Mexico, but also in many Central and South American countries that the frequencies will have to be active, or they will be deleted from the ITU register of frequency allocations.

The return to shortwave was first reported when XEQQ returned to 9680 kHz and has been heard from 1200-0600 UTC, using 500 watts and a dipole antenna. XEW opened in September, 1930 and now XEWW is back in operation on three frequencies, 6165, 9515, 15169 or 15177 kHz, using low power with 500 watts on each frequency. After more than 12 months of silence, another station returned

to the air: XEEP, operated by the Mexican Ministry of Education, has appeared on 6185 kHz operating 24 hours. Its medium-wave frequency 1060 kHz is well heard in New Zealand around 0700 UTC with classical music. XEEP has announced that a 10 kW transmitter may be used on 6185 kHz if budget allows.

Government operated XERMX Radio Mexico International is also in a state of uncertainty. They planned to add French, Portuguese and German to their five minute English news broadcast, but the new budget has cut this expansion programme.

Radio Mexico International purchased a 100 kW shortwave transmitter in 1979, but never installed it while the present 15 year old transmitters in use are due for replacement. Only two frequencies are now reported with XERMX transmissions on 9705 and 15430 kHz, 2000-2300 UTC and 0300-0500 UTC; the

signal best received is at 0500 UTC on 15430 kHz.

International broadcasting is still for some countries a prestige symbol and is sometimes used in advertising brochures. Time will tell, but the stern warning from the Mexican Federal Transport

and Communications Ministry in preparing its requirement for the World Administrative Radio Conference and the ultimatum to domestic broadcasters to use their shortwave outlets or lose them, should have results.

— Arthur Cushen

These verification cards from six shortwave stations operating from Mexico in the 1930-40s are from broadcasters which have not been heard for many years, but the recent action by the Mexican government will force the stations to relinquish their shortwave frequencies or reactivate the stations.



## Data communications publication

A new book *Australia's Communications Revolution* will be published shortly to give people an insight into the dramatic changes taking place in communications. It covers things like satellites, cable TV, Teletext, Videotex (including Viatel, of course), Austpac, Teletex and Telememo, facsimile, paging systems, the new digital PABXs, etc. It is written and presented in an easy to read, informative fashion for the inter-

ested lay reader, and with lots of illustrations.

The editor of the book is Stewart Fist, the well-known and respected freelance technical writer. Anticipated publication date is very early October — a very appropriate time, with the Australian satellite going up, Telememo starting and so on.

The book is to be distributed through newsagents, electronics and computer outlets.

## Satellites mean the BBC sounds better

The BBC has now linked all its relay bases with direct satellite transmissions from its Bush House studios in London, and listeners in Australia have improved quality of reception, particularly through the relay base at Singapore.

Earlier this year World Service listeners living in South America and west, central and southern Africa will have noticed a significant improvement in the clarity of transmissions coming to them from the BBC Atlantic relay station on Ascension Island. In particular music and drama programmes will have gained a new sparkle, but items like the World News now have an improved sound quality.

This new and improved sound quality comes to listeners by way of the Atlantic Ocean Intelsat V satellite, one in the latest group of geostationary communications satellites providing significantly improved worldwide communications.

From the BBC External Services studio centre in Bush House, programmes in digital form are routed first to British Telecom's satellite ground station at Madley Heath in Hereford. They are then beamed up to the Intelsat V Atlantic ocean satellite positioned in a geostationary orbit some 36,000 km above the earth. Programmes are re-radiated from the satellite and received on a special dish

aerial at the new satellite earth station that has recently been built adjacent to the BBC transmitter station on Ascension Island.

The opening of this satellite link to Ascension Island is the final stage in the BBC external services project to provide its major overseas relay bases with high quality programme feeds.

Listeners in Central and North America and the Caribbean served by BBC transmission from Antigua have had the benefit of this much improved programme quality since mid-December. Those in south and South East Asia, Australia and New Zealand listening to BBC programmes from Singapore, Cyprus or Masirah will by now regard the improved reception quality as normal. Beginning in October 1982 these stations became progressively satellite fed via the Indian Ocean Intelsat V.

Listeners with two receivers, one tuned to the BBC transmissions from the United Kingdom and the other to a BBC relay base, will note that there is a quarter of a second between the broadcasts as the one direct from the United Kingdom will reach your receiver first, while the one from the relay base has to travel 72,000 kms from Bush House up to the satellite and down to your receiver.

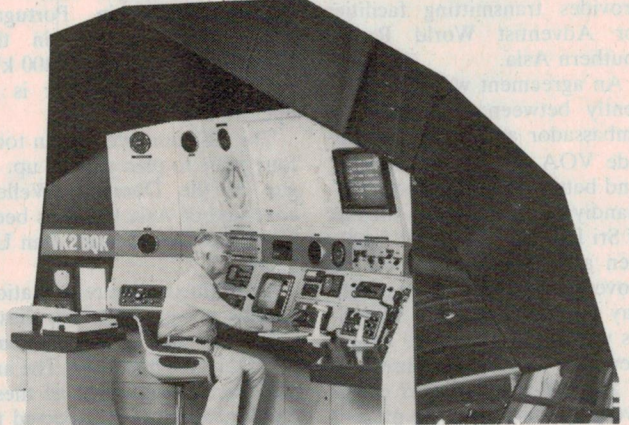
Arthur Cushen



Bush House London, from which all External Service broadcasts originate.

### Museum station

Amateur station VK2BQK has been set up as a major demonstration and communications exhibit for Sydney's Power House Museum, due to be completed in 1988. Manned by licensed volunteers, the station is capable of 2-way contact with other amateurs throughout the world on HF, VHF and UHF. The station will be operational between 12 noon and 4 pm on weekdays, public holidays and on Tuesdays between 11 am to 1 pm, and 2 pm to 4 pm. Bookings, which are necessary, can be made on (02) 217-0222.



### Pirate satellites predicted for Europe

Renegade satellite launching is predicted in recent International Resource Development Inc report. The report suggests that this might develop in three ways. Firstly, a company already using a satellite might switch from its original contracted purpose and start advertising internationally; secondly, a well financed private company might launch a craft of its own (creating obvious space traffic problems among others); but most likely, the report proposes, is that an ambitious country, impatient with administrative issues might launch a satellite regardless of consequences. Because of the difficulty in retrieving satellites or policing violations of agreements, the company or nation might feel that repercussions would be worth getting the satellite up.

### The new car aerial

The new Bosch Autoflex aerial is another goody for the radio listening motorist. It measures 45 cm from tip to bottom of mounting on the car body and pulls in a stronger AM signal with an impedance transformer built into its base. Alternating wiring directions on the helical whip assist in better FM reception. For more information contact Robert Bosch (Aust) on (03)544-0655.

### RTTY/CW modulator-demodulator

The MDK-17 radio teletype and CW modulator-demodulator is available in kit form (\$118) or fully assembled and tested (\$181) from GFS Electronic Imports. The MDK-17 can be interfaced with most computers through its TTL level I/O port. GFS is at 17 McKeon Rd, Mitcham, Vic 3132, (03)873-3777. P&P is \$14 in both cases.

### Microprocessor controlled shortwave radio receiver

The Uniden CR 2021 receiver includes a built in scan, auto lock on and memory, and a preset for six stations. It's available from Zap Electronics, which can be contacted on (02)858-2288, for \$299.

## Sri Lanka — host to international broadcasts

There is no country in the world that hosts more international broadcasters than Sri Lanka which is the home of relay bases for Voice of America, Deutsche Welle, and Trans World Radio. As well as this, the Sri Lanka Broadcasting Corporation also provides transmitting facilities for Adventist World Radio, southern Asia.

An agreement was signed recently between the American ambassador and SLBC to provide VOA a 1000 acre area of land between Chilaw and Nathandhiya on the north west coast of Sri Lanka. About 200 fishermen and their families will be moved to other land to clear the way for the new relay station. As well as high powered equipment for VOA, one transmitter of 250 kW is to be used exclusively by the SLBC. At present VOA operates three 35 kW transmitters from Sri Lanka. These are located at Ekala, while a receiving station at Seeduwa feeds the incoming VOA programmes for retransmission.

The new relay base of Deutsche Welle is in operation and is located at Trincomalee. It consists of three 250 kW transmitters. This is the fifth relay base established by Deutsche Welle, Voice of Germany. Others are at Kigali in Ruanda Urundi, Sines in Portugal, Malta, and Antigua in the Caribbean. As well, a 400 kW mediumwave transmitter is in operation in 1548 kHz.

The Trincomalee station took four years to plan and set up. A gap in the Deutsche Welle's coverage of Asia has thus been filled at a cost of more than US \$20m.

The Trincomalee relay station obtains power from two diesel generators with a maximum output of around 5000 kW. The annual fuel consumption of these diesel generators is expected to amount to five million litres. High gain antennas direct the radio frequencies beamed into the various target areas. A group of curtain antennas has been installed for both the eastern and the western directions

while another group, designed to cover south Asia, beams to the north. The mediumwave transmitter is linked to a two-mast antenna which is also directed to the north.

Primarily, the Trincomalee relay station will serve the area ranging from New Zealand and Australia, up to Japan and China, and across to India and some parts of the Middle East. At night it will also cover the eastern part of Africa. The programmes, which are in German and a dozen other languages and are all produced in Cologne, are fed into the Sri Lanka station via an Intelsat satellite.

The receive-only Intelsat ground station, which has an antenna eleven metres in diameter, guarantees optimum modulation quality for the transmissions from Sri Lanka. For technical monitoring and for feeding the transmitters in the event of a break in the satellite link, there is a remote-controlled receiving station equipped for reception of all shortwave broadcasting bands.

Up to 12 German specialists operate the station, and are engaged in training local staff. It is planned to reduce the number of German staff as Sri Lankan staff develop technical skills through the training programme.

Trans World Radio, Sri Lanka, operates only on medium-wave and uses 882 kHz with a power of 400 kW. The station carries gospel programming and operates 1330-1700 UTC at a time when reception is possible in Australia.

The Sri Lanka Broadcasting Corporation operates an external service to Australia 1030-1130 UTC on 11835, 15120 and 17860 kHz. During this transmission they carry programmes for Adventist World Radio, southern Asia, which has recording studios in Poona, India. The broadcasts on Sunday 1100-1130 UTC under the title "Radio Monitors International", include station profiles and information for the short-wave listener, prepared by Adrian Peterson.

— Arthur Cushen

## Broadcasting from inside tunnel

Now Canada has its first tunnel radio at Montreal. It is estimated that 1.3 million Canadians, mainly French speaking, each week will be entertained by this new broadcasting station in Montreal, as they travel through the tunnel. The programme is transmitted on 14 frequencies on the mediumwave dial, equivalent to the 14 stations broadcasting in the Montreal area, so that immediately a motorist listening to a Montreal station, for instance CBM 940 with English programming, or CKLM 1570 in French, enters a tunnel and loses a signal, it is replaced by the tunnel radio CHLA.

The concrete and steel of any tunnel effectively shields reception of any radio station and this is particularly so under the St Lawrence river. The transmitter operates with 14 carriers carrying a common programme and the length of the tunnel is fed

with a radiating cable which acts as the antenna. Under normal traffic conditions, it takes one minute and 15 seconds to go under the tunnel, so the station's programme is based on a five minute section. When there is heavy traffic it could take five minutes to move through the tunnel.

The programme consists of public service messages and commercials, which are restricted to 15 seconds at a cost of \$8.50. The majority of the programme is in French, but there are some English announcements. The studios of CHLA are located one and a half kilometres from the tunnel, but the transmitter is inside the tunnel and the whole programme is on a computer which runs the entire operation.

The United States pioneered Tunnel Radio with three stations already in operation in

Fort Lauderdale (Florida), Baltimore (Maryland), and Boston (Massachusetts) which have already proved successful. According to an interview on Radio Nederland, this new

Canadian station is certain to hold an attentive audience while travelling under the tunnel as there is no other competitive radio service in such a situation.

## Rescue squad uses SX-155

Microcomm's model SX-155 programmable scanning receiver is now in use by one of Southern Victoria's busiest rescue organizations, the Southern Peninsula Rescue Squad.

During the busy summer holiday period on the Mornington peninsula the squad of volunteers assists in accidents using equipment which includes a Bell 206 helicopter, two boats and a four wheel drive vehicle.

For liaising purposes the squad has acquired a Microcomm SX-155 which features 160 memories and

HF/VHF/UHF frequency coverage, as well as rechargeable batteries, high sensitivity and heavy duty extruded aluminium construction.

The Southern Peninsula Rescue Squad is a volunteer organization funded largely by donation, and any gift in the way of equipment or money would be gratefully accepted. Contact them through SPRS, Hotham Rd, Sorrento, Vic 3943.

For further information on the scanner contact GFS Electronic Imports, 17 McKeon Rd, Mitcham, Vic 3132. (03) 873-3777.

## Coastal radio services improved

The Coast Radio Service of OTC will soon be taking delivery of twenty-two new Marconi 10 kW fast tuning HF transmitters made and assembled by GEC Australia in Sydney. The contract, valued at over \$2m, is part of a major programme for re-equipping and rationalizing the Maritime Coast Radio Service facilities in Sydney and Perth.

The new transmitters will enable OTC to phase out thirty-year-old equipment which has been handling HF traffic from shipping in the Indian and Pacific Oceans. OTC plans eventually to remotely control the transmitters at both sites from the CRS operating centre at La Perouse.

The Marconi fast tuning HF amplifier H.1141 is housed in a single cabinet and contains a digital control system. The transmitter provides an output

of 10 kW peak envelope power over the frequency range of 1.6 MHz to 30 MHz. An input at radiated frequency of any level between 50 mW and 150 mW (or 1 W to 2 W with internal attenuator), will drive the amplifier to full power.

The CRS has a total of fourteen radio stations distributed throughout Australia, most having low powered transmitters in the 1-2 kW range. The receiving station at Bringelly is to get new equipment and antennas as part of the same rationalization programme and will eventually be controlled from the La Perouse operating centre.

OTC is also installing twenty-seven Eddystone fixed frequency receivers to keep continuous watches on the safety of life at sea (SOLAS) international distress frequencies of 500 and 2182 kHz.

## KILOHERTZ COMMENT

**AUSTRALIA:** The latest station operated for the print handicapped listener is 1PHR in Canberra. Other stations have been using the call sign RPH (radio for the print handicapped), but the Canberra station is announcing as 1 print handicapped radio. Broadcasts are on 1620 kHz with 500 watts, and the schedule is announced as 1900-1305 UTC. Transmissions towards the end of the day suffer in New Zealand from the other two RPH stations on the frequency, in particular 7RPH Hobart. 1PHR has a short devotional service at 1300 UTC and closes at 1305 UTC using "Elizabethan Serenade" as the signature tune.

**NEW ZEALAND:** Radio New Zealand International broadcasts to Australia are 2345-0145 UTC 15150 kHz; 0345-0730 UTC 11780 kHz; 1030-1215 UTC on 9600 kHz and 11780 kHz. The transmissions to the Pacific Islands are 1845-2115 UTC 11780 kHz; 2345-0145 UTC 17705 kHz; 0345-0730 UTC 15150 kHz. The schedule, effective September 1, is tentatively given as the one printed above.

**NORWAY:** Radio Norway in a service to Australia, is operating 0600-0645 UTC on 15165 kHz; 1000-1045 UTC on 17740 kHz. The service to New Zealand 0700-0745 UTC is on 9590 kHz and 1000-1045 UTC 15180 kHz. On Sundays the first 30 minutes of the programme is in Eng-

lish, in some transmissions, including the broadcast at 1000 UTC.

**SPAIN:** Madrid's English transmission 0500-0600 UTC is now on 5970 kHz as well as 9630 kHz. This new frequency suffers from jamming during the transmission, but another new channel 6125 kHz does provide good reception. During the Monday transmission there is a special programme for short-wave listeners, at 0548 UTC; while Tuesday to Saturday Spanish lessons are broadcast at this time.

**SWEDEN:** Radio Sweden is continuing to use 15115 kHz to Australia with English 1100-1130 UTC. The transmission in Swedish at 1000-1030 UTC is on 17820 kHz. Listeners in Australia should also get good reception at 0230 UTC in English on 9695 kHz, while a repeat transmission at 0300 UTC is on 11750 kHz. Radio Sweden's popular Sunday feature "Mailbag" has been discontinued as a weekly feature and listeners' letters are now answered on a daily basis.

This item was contributed by Arthur Cushen, 212 Earn St, Invercargill, New Zealand, who would be pleased to supply additional information on medium and shortwave listening. All times quoted are UTC (GMT) 10 hours behind Sydney time, all frequencies are in kilohertz (kHz).

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# HOW GOOD IS YOUR TRANSCEIVER?

Specifications can be your slave or your master, depending on how you read them. Everybody likes to pull a few tricks out of the bag and you have to be pretty foxy with figures to catch the rabbit. But the figure is not quicker than the eye and neither is the informed reader the disbelieving cynic.

David J. Williams  
BE, MIREE, MIEE

AMATEUR OPERATORS, like car buffs, have been known to argue heatedly over merits and demerits of their favourite boxes. Great store is placed in published figures with even greater efforts are made to back them up with 'on air' or 'on road' exposure.

Spec figures like statistics can be 'manipulated' to indicate adequate performance figures, but when put under scrutiny, reveal inadequacies both in performance of the equipment and correctness of engineering definition.

While there is some difference between amateur engineering standards and professional or commercial engineering standards, manufacturer's should make clear into which group their product falls with specifications accordingly.

In this and future issues we will be reviewing a range of amateur and some professional equipment. We will be referring to accepted engineering standards regardless of the status of the product and where we feel the manufacturer's published specifications are misleading or ambiguous, or the product tested inadequately, we will say so.

For example, frequency stability of a transmitter may be expressed as "better than  $\pm 10$  ppm at 144 MHz". This means that at some time and temperature, the transmitter would be no more than  $\pm 1.44$  kHz off frequency when operating on 144 MHz. A stability of  $\pm 1.44$  kHz is reasonably good if it is the long term drift over one year. It is poor stability if the same drift takes place over the course of a 30 minute contact. How much better to say something like "after 10 minute warm up, stability is better than 1 part in  $10^8$ /°C. Long term aging less than one part in  $10^9$  per day".

Therefore we have compiled our performance specifications list which we believe constitutes very good performance for both transmitters and receivers at VHF/UHF. It

should also be kept in mind that amateur equipment today can offer performance that was only obtained from professional equipment 10 years ago. Our reviews will, of course, test according to today's standards. Readers can decide for themselves those parameters of greatest interest and thus make comparisons.

Our weapons when making tests are set out below.

## Equipment used

1. HP 141T spectrum analyzer with appropriate IF and rf plug in.
2. Rhode & Schwarz SMS-2 rf signal generators. 100 kHz-1040 MHz.
3. Fluke frequency standard receiver with Tracor MSK converter and Fluke frequency comparator. Frequency measuring ability to 1 part in  $10^{12}$ .
4. Weinschel VM3 attenuator calibration equipment.
5. Coaxial Dynamics power meter and dummy loads.

## Performance specification for VHF/UHF transceivers

### RX SENSITIVITY:

SSB 0.2  $\mu$ V emf for 10 dB SINAD in 3 kHz bandwidth

### FM Peak deviation

30% of bandwidth 0.4  $\mu$ V emf for 12 dB SINAD

### INPUT IMPEDANCE:

50 ohms nominal resistive

Third order IMD intercept (dBm) 0

Noise floor (MDS): -140 dBm, SSB; 2.5 kHz BW

Inband intermodulation: -40 dB

Blocking: DR -130 dB

Reciprocal mixing: (local oscillator noise sidebands)  $< -90$  dB @ 20 kHz.

Spurious responses:  $< 10$  dB S/N ratio or less than equivalent MDS level.

IF rejection: 100 dB minimum

Image rejection: 100 dB minimum

### TRANSMITTER:

Spurious outputs (all) products: -70 dB<sub>c</sub>

3rd order IMD (2 tone) -35 dB

Carrier suppression: -60 dB<sub>c</sub>

Unwanted sideband: -60 dB<sub>c</sub>

### GENERAL:

Frequency stability after 15 minute warm up, less than 2 ppm over any one hour period.

Although some of the above terms may appear frightening and of academic interest, taken together they expose a receiver/transmitter for what it is. Let us look at some of the terms and hopefully put some light on otherwise dark areas.

## Definitions explained

**Third order intercept:** is a measure of receiver front end linearity when strong signals mix in front end. It is measured in dBm and the higher the figure the better the front end characteristics.

**Noise floor (MDS):** is minimum discernible signal for a given bandwidth: 3 dB (S+N)/N.

**Blocking:** is a measure of desensitization produced by a strong signal at a given frequency separation from the wanted signal.

Sometimes the above figures may be referred to as a dynamic range. For example a figure may be obtained by subtracting from the MDS the parameter, ie, blocking dynamic range is MDS-blocking.

**Reciprocal mixing:** is due to high level unwanted signals mixing with noise sidebands of the local oscillators which produces noise products at the wanted receive frequency. Method of measurement is similar to that used when doing a blocking test. Carrier-to-noise ratios are sometimes normalized to a 1 Hz bandwidth. The observed effect is to raise the noise level of the receiver and the higher the specified dB level, the better the reciprocal mixing.

*Spurious responses:* These are responses of the receiver to signals generated within the receiver itself. They can originate from any oscillators, digital circuitry etc, and should be less than 10 dB above receiver noise level.

*"S" meter response:* We have elected to use the response as recommended by the IARU (the International Amateur Radio Union). This says that S9 should be at 50  $\mu$ Vpd or 100  $\mu$ V emf and that each "S" point should be at 6 dB intervals.

At this point let us offer a word of explanation with reference to pd (potential difference) and emf.

Receiver sensitivities, if expressed in microvolts, usually refer to potential difference, which in a matched impedance system, gives a figure *half* the emf. If not looked at with care, pd specifications can make the receiver sensitivity look twice as good as might otherwise be the case.

We have elected to use dBm and shown the corresponding figure in  $\mu$ V. This allows for no ambiguity as dBm is a power measurement into 50 ohms. Thus 0 dBm is 1 mW in 50 ohms or 224 mVrms.

All test parameters have some bearing on how well the equipment should perform. Some of these specifications should not be taken in isolation — sensitivity figures that look good according to accepted standards, may be the source of other receiving difficulties in practice. Good sensitivity might be at the expense of poor intermodulation and blocking, as well as selectivity. In HF equipment manufacturers of professional receivers use either or both front end attenuators and octave filters to improve intermodulation figures.

If operating in a crowded spectrum is your problem, a receiver which is correctly specified to what might appear as mediocre sensitivity, may produce excellent intermodulation and adjacent channel performance. Look too, at what devices are used in the front end; very good intermodulation figures are being obtained by using FETs.

Having thus tested almost every parameter, users now have some valuable criteria against which they can evaluate their pride and joy. Deep and meaningful may bring out better understanding and possibly increase the letters to the editor! We look forward to providing answers.

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- ★ Most REPEATERS have their licence, power and site cost paid by the institute.
- ★ World wide QSL-service.
- ★ Assistance to members in legal problems arising out of the pursuit of their hobby.
- ★ A Weekly Sunday Broadcast to Amateurs and Short Wave Listeners.
- ★ Assistance in dealing with Interference Problems (TVI-RFI etc.)
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- ★ The ONLY representation of the RADIO AMATEUR in legislative matters.



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W.I.A. P.O. BOX 300,  
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# We want your business!

Having moved up in the world with our bigger and better warehouse in Clayton, Ritronics Wholesale are looking to increase their clientele. With our extensive range, (over 7,000 different products) excellent "in stock" availability and even better deals, we're confident that you will find us more than satisfactory in your pursuit of the latest electronic products and components at very competitive prices.

Please find listed below a sample of our competitive wholesale pricing for a fraction of the range of products we import and are distributors for. Please feel free to ring Peter Jones or Dean Wilson for competitive quotes on all your components and computer peripheral needs.

Please note minimum account orders for these prices is \$50 per order. Minimum Cash Sale or Mail Order is \$20.

Best regards, Rod Irving

PLEASE DIRECT ALL SALES ENQUIRIES TO:  
Clayton (03) 543 2166 (3 lines)



## COMPUTER CONNECTORS

Cat No.	Description	1-99	100+	1000+
P10900	DB25 Plug	1.30	1.20	1.00
P10901	DB25 Socket	1.40	1.30	1.20
P12210	Centronics Solder	3.50	3.15	2.50
P12200	Centronics Crimp	6.00	5.50	5.00
P10880	DB9 Plug	1.30	1.20	0.90
P10881	DB9 Socket	1.40	1.30	1.00
P10890	DB15 Plug	1.30	1.20	0.90
P10891	DB15 Socket	1.40	1.30	1.00
P10902	DB25 Cover	.80	.75	.70

Plus 20% tax where applicable



## CANNON TYPE AUDIO CONNECTORS

We've sold 1000's because of their great value!!

Cat No.	Description	1-99	100+
3 Pin Line male Cat. P10960		1.60	1.50
3 Pin Chas male Cat. P10962		1.70	1.60
3 Pin Line female Cat. P10964		2.10	1.80
3 Pin Chas FMe Cat. P10966		2.50	1.90

Plus 20% Sales Tax where applicable



## CARD EDGE CONNECTORS

Edge Connectors to Disk Drives Etc.

Cat No.	Description	10-24	25-99	100+
P12060	10 Way Card Edge Con	2.95	2.50	2.10
P12062	20 Way Card Edge Con	3.25	2.75	1.95
P12064	26 Way Card Edge Con	3.55	2.95	2.30
P12066	34 Way Card Edge Con	3.95	3.50	2.30
P12068	40 Way Card Edge Con	4.50	3.90	3.50
P12070	50 Way Card Edge Con	5.50	4.50	3.90

Plus 20% Sales Tax where applicable



## IDC SOCKETS

Cat No.	Description	1-99	100+	1000+
P12100	10 Pin Socket	1.95	1.75	1.25
P12101	16 Pin Socket	2.25	2.05	1.65
P12102	20 Pin Socket	2.45	2.25	1.90
P12104	26 Pin Socket	2.65	2.45	2.00
P12106	34 Pin Socket	2.75	2.55	2.15
P12108	40 Pin Socket	2.95	2.75	2.25
P12110	50 Pin Socket	3.50	2.95	2.50

Plus 20% Sales Tax where applicable

## IDC CONNECTORS

Cat No.	Description	1-99	100+
P12114	14 Pin Dip Plug	0.60	0.50
P12116	16 Pin Dip Plug	0.65	0.55

Plus 20% tax where applicable

## RCA CHASSIS MOUNT METAL

Cat No.	Description	1-99	100+
P10231	0.16 0.13		

Plus 32 1/2% tax where applicable

## RCA INSULATING SOCKETS

Cat No.	Description	1-99	100+
P10232	2 Way	0.25	0.21
P10234	4 Way	0.45	0.40
P10236	6 Way	0.75	0.60

Plus 32 1/2% tax where applicable

## R.A HEADERS

Cat No.	Description	1-99	100+
P12241	R.A. 10Way Unprot Head	1.45	1.30
P12247	R.A. 16Way Unprot Head	1.55	1.40
P12251	R.A. 20Way Unprot Head	1.65	1.45
P12257	R.A. 26Way Unprot Head	1.70	1.50
P12261	R.A. 30Way Unprot Head	1.95	1.85
P12265	R.A. 34Way Unprot Head	2.15	1.95
P12271	R.A. 40Way Unprot Head	2.45	2.15
P12276	R.A. 50Way Unprot Head	2.95	2.70
P12281	R.A. 60Way Unprot Head	3.15	2.95

Plus 20% Sales Tax where applicable

## UNPROTECTED HEADERS STRIP HEADERS

Dual in Line 2.54mm

Cat No.	Description	1-99	100+
P12240	10 Way Unprot Header	1.25	1.10
P12246	16 Way Unprot Header	1.35	1.20
P12250	20 Way Unprot Header	1.45	1.25
P12256	26 Way Unprot Header	1.50	1.40
P12260	34 Way Unprot Header	1.75	1.65
P12264	40 Way Unprot Header	1.95	1.75
P12270	50 Way Unprot Header	2.25	1.95
P12275	60 Way Unprot Header	2.75	2.50
P12280	80 Way Unprot Header	2.95	2.75

Plus 20% Sales Tax where applicable

## VOLTAGE REGULATORS

Cat No.	Description	10+	100+	1000+
7805uC		.45	.44	.43
7805Kc		1.50	1.40	1.20
7812uC		.45	.44	.43
7815Kc		1.50	1.40	1.20
7818uC		.50	.49	.48
7818Kc		1.50	1.40	1.20
7905uC		.70	.60	.55
7912uC		.70	.60	.55
uA323Kc		4.50	3.90	3.75
78H12		7.00	6.00	5.90
78HGKc		7.50	6.50	6.00
78HGKc		16.50	16.00	14.00
78P05		11.50	11.00	10.50
78P12		14.00	13.50	13.00

Plus 20% tax where applicable



## ELECTROLYTICS

Cat No.	Description	10+	100+
R1415	1uF 63VPCB RB	0.05	0.04
R15461	10uF 16VPCB RB	0.05	0.04
R15462	10uF 25VPCB RB	0.05	0.04
R15482	22uF 25VPCB RB	0.06	0.05
R15521	47uF 16VPCB RB	0.07	0.06
R15522	47uF 25VPCB RB	0.08	0.07
R15581	1000uF 16VPCB RB	0.21	0.20
R15582	1000uF 25VPCB RB	0.28	0.25
R15591	2200uF 16VPCB RB	0.39	0.33
R15592	2200uF 25VPCB RB	0.55	0.50
R15904	2200uF 50V AXIAL	1.50	1.00

Plus 32 1/2% tax where applicable

## RG CAN TYPE WITH LUGS

Cat No.	Description	1-99	100+	250+
R164585	8000uF 75V	6.00	5.90	5.80
R16587	10,000uF	7.00	6.50	5.90
		10+	100+	
R15593	2200uF 35v RB	.70	.65	
R15531	100uF 16v RB	.07	.06	
R15465	10uF 63v RB	.07	.06	
R15535	100uF 63v RB	.18	.17	
R15532	100uF 25v RB	.08	.07	

Plus 32 1/2% tax where applicable

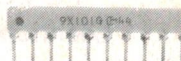
## DIODES

Cat No.	Desc.	10+	100+	1000+	100K+
Z10135	IN4148	0.03	0.02	0.015	.013
Z10105	IN4002	0.04	0.03	0.03	.025
Z10107	IN4004	0.05	0.04	0.03	.025
Z10110	IN4007	0.10	0.06	0.05	.040
Z10115	IN5404	0.18	0.14	0.09	0.08
Z10119	IN5408	0.20	0.16	0.10	0.09

Plus 20% tax where applicable

## RESISTORS

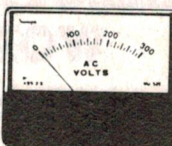
1/4 WATT E12 CARBON BULK  
PACKED \$5.25/1000  
TAPED AND BOXED \$5.25/1000  
\$5.00/1000 10K LOTS  
1/4 METAL FILM TAPED AND BOXED  
\$12.00/1000 \$11.00/1000 10K LOT  
SUPPLY E24 VALUE  
Plus 32 1/2% tax where applicable



## SIP RESISTORS

Standard values.

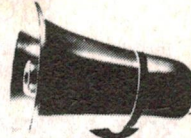
Cat No.	Description	1-99	100+
6 Pin		0.50	0.40
8 Pin		0.60	0.50
10 Pin		0.65	0.60



## PANEL METERS

Cat No.	Description	1-99	100+	1000+
Q10500	MU45 0-1mA	5.95	5.75	5.50
Q10502	MU45 50-0-50uA	5.95	5.75	5.50
Q10504	MU45 0-100uA	5.95	5.75	5.50
Q10505	MU45 0-50uA	5.95	5.75	5.50
Q10510	MU45 0-5A	5.95	5.75	5.50
Q10518	MU45 0-1A	5.95	5.75	5.50
Q10520	MU45 0-20V	5.95	5.75	5.50
Q10535	MU45 VU	6.95	6.75	6.50
Q10530	MU52E 0-1mA	7.95	7.35	
Q10533	MU52E 0-5mA	7.95	7.35	
Q10538	MU65 0-50uA	9.35	8.95	8.75
Q10540	MU65 0-1mA	9.35	8.95	8.75
Q10550	MU65 0-100uA	9.35	8.95	8.75
Q10560	MU650 0-20v	9.35	8.95	8.75

Plus 20% tax where applicable



## HORN SPEAKERS

Cat No.	Description	1-99	100+
C12010	5" Plastic 8W Max	4.80	4.70
C12015	5" Metal 8W Max	4.70	4.30
C12012	12V Siren	8.50	8.00

Plus 20% tax where applicable



## MINITURE BUZZER

5-15V White or black  
Cat. A15062 10-99 100+  
0.90 0.80  
Plus 20% tax where applicable



## MEMORY

"Check for the latest memory prices!"

Cat No.	Description	10-99	100+	1000+	10K+
4164-15P		\$1.90	\$1.50	\$1.35	\$1.00
41256		\$10.00	\$9.00	\$8.50	\$8.00
6116P-3		\$4.00	\$3.90	\$3.00	\$2.80
2708		\$9.00	\$8.00	\$7.00	
2716		\$4.90	\$4.50	\$4.25	\$4.00
27128		\$9.00	\$8.00	\$6.00	\$5.00
2532		\$7.50	\$6.50	\$6.40	\$6.30
2732		\$6.50	\$6.10	\$5.90	\$5.50
27256		\$29.00	\$27.00	\$22.00	19.00

Plus 20% tax where applicable

## IC's GALORE!

Cat No.	Description	1-99	100+	1000+	250+
8035		3.90	3.70	3.50	3.00
8085		4.00	3.90	3.50	3.00
8088		19.00	18.00	15.00	14.00
8155		3.90	3.75	3.50	3.00
8156		3.50	3.30	2.90	2.50
8212		1.90	1.70	1.50	1.00
8224		2.40	2.00	1.90	1.50
8226		1.90	1.70	1.50	1.00
8237A		35.00	31.00		
8253		3.90	3.70	3.50	3.00
8255		4.00	3.50	2.90	2.00
8257		3.90	3.50	3.00	2.50
8259		3.90	3.50	3.30	2.70
8237A		35.00	31.00		
8279		3.90	3.50	3.30	2.70

Plus 20% tax where applicable

## LOW PROFILE IC SOCKETS

How cheap can they go ??

Cat No.	Description	10+	100+	1000+	10K
8 Pin		.08	.07	.06	.05
14 Pin		.10	.09	.08	.07
16 Pin		.11	.10	.09	.08
18 Pin		.12	.11	.10	.09
20 Pin		.13	.12	.11	.10
22 Pin		.14	.13	.12	.11
24 Pin		.15	.14	.13	.12
28 Pin		.17	.15	.14	.13
40 Pin		.25	.24	.22	.20

Plus 20% tax where applicable

## BRIDGES

Cat No.	Description	10+	100+	1000+	10K+
6A 400V		1.00	0.80	0.75	0.69
W02		0.24	0.23	0.20	0.18
W04		0.25	0.24	0.21	0.19

Plus 20% tax where applicable



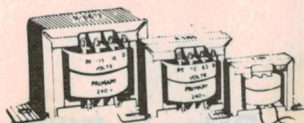
## CRYSTALS

Cat No	Frequency	Can	10+	100+	500+	1000+
Y11000	1MHz	HC33	5.50	4.75	4.50	4.00
Y11005	2MHz	HC33	5.50	4.75	4.50	4.00
Y11008	2.575MHz	HC33	2.25	1.95	1.85	1.70
Y11015	5.3954MHz	HC18	1.20	90	65	60
Y11020	4.04MHz	HC18	1.30	90	75	60
Y11022	1.94304MHz	HC18	1.40	90	75	60
Y11025	4.75MHz	HC18	1.40	90	75	60
Y11026	4.915MHz	HC18	1.40	90	75	60
Y11042	6.142MHz	HC18	1.40	90	75	60
Y11050	8.0MHz	HC18	1.40	90	75	60
Y11055	10.0MHz	HC18	1.40	90	75	60
Y11070	12.0MHz	HC18	1.40	90	75	60
Y11072	14.318MHz	HC18	1.40	90	75	60
Y11080	16.0MHz	HC18	1.40	90	75	60
Y11085	18.432MHz	HC18	1.40	90	75	60
Y11090	20.0MHz	HC18	1.40	90	75	60

## POLYESTER 100V "GREENCAP" TYPE

Cat No.	1-99	100+	1000+
R15131	.001uF	0.06	0.04
R15137	.0012uF	0.06	0.04
R15138	.0015uF	0.06	0.04
R15140	.0022uF	0.06	0.04
R15142	.0033uF	0.06	0.04
R15143	.0039uF	0.06	0.04
R15145	.0047uF	0.06	0.04
R15146	.0056uF	0.06	0.04
R15147	.0062uF	0.06	0.04
R15148	.01uF	0.07	0.05
R15150	.015uF	0.07	0.05
R15152	.022uF	0.07	0.05
R15154	.033uF	0.07	0.05
R15155	.039uF	0.07	0.05
R15156	.047uF	0.08	0.06
R15157	.056uF	0.08	0.06
R15158	.068uF	0.08	0.06
R15159	.082uF	0.08	0.07
R15160	.1uF	0.09	0.08
R15162	.15uF	0.11	0.10
R15164	.22uF	0.15	0.14
R15165	.27uF	0.16	0.15
R15172	.1uF	0.70	0.55
R15176	2.2u	1.20	1.10
R15178	3.3uF	1.50	1.20

Plus 32 1/2% tax where applicable



## TRANSFORMERS

Cat No.	1-99	100+	1000+
M12851	2851	2.50	2.25
240V 12-6V CT 150mA			1.90
M12155	2155	4.80	4.10
240V 6-15V 1A tapped			3.70
M12156	2156	6.35	6.15
240V 6-15V 2A tapped			5.95
M16672	6672	6.35	6.15
240V 15-30V 1A tapped			5.95

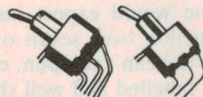
Plus 20% tax where applicable



## ENCLOSED ROTARY SWITCHES AT SPECIAL PRICES!!

S13021	SW ROT 1P 12Pos	1-9	10+	100+
		1.00	.80	.70
S13022	SW ROT 2P 6Pos	1.00	.80	.70
S13033	SW ROT 4P 3Pos	1.00	.80	.70
S13035	SW ROT 3P 4Pos	1.00	.80	.70

Plus 20% Sales Tax where applicable



## NEW SWITCHES

SPDT Cat.	10-99	100+
S11040	1.00	.95
DPDT Cat. S11042	1.20	1.00

Plus 20% Sales Tax where applicable

## QUALITY MOMENTARY (RED BODY)

SPDT Cat.	10-99	100+
S11050	1.00	.90

Plus 20% Sales Tax where applicable

## ECONOMY TOGGLE SWITCHES

S11010 (SPDT)	10-99	100+
	0.70	0.60
S11020 (DPDT)	0.90	0.80

Plus 20% Sales Tax where applicable



## YU-FONG YFE-1030C

- Features:**
- Large 3 1/2 digit display. (1/2 inch high)
  - Autopolarity. "-" display for Negative input.
  - High over-load protection for all ranges.
  - Over-load display highest figure "1" or "-1" alone glows.
  - Power consumption 20mW approx.

Cat. Q126030

1-99	100+
43.95	34.00

## DIGITAL MULTIMETER YFE YF1100

- Large easy to read 3 1/2 digit display.
- Facilities for transistor and diode testing.
- Clearly laid out front panel.
- 10A DC AC range.
- Priced to undersell the others.

YF1100	1-99	100+
	59.50	57.50

Plus 20% tax where applicable

## TRANSISTOR

2SJ49	10-99	100+	2SK134	10-99	100+
	3.90	3.70		3.90	3.70
PN2222A	.10	.08	PN2907A	.10	.08
PN3463	.15	.13	PN3565	.12	.11
PN3566	.15	.13	PN3567	.10	.08
PN3569	.18	.16	PN3639	.18	.16
PN3640	.18	.16	PN3641	.10	.08
PN3642	.10	.08	PN3643	.10	.08
PN3644	.15	.13	PN3645	.15	.13
PN4250A	.15	.13	PN4355	.16	.14
PN4356	.16	.14	MPSA42	.23	.20
MPSA43	.23	.20	MPSA55	.15	.14
MPSA46	.15	.14	MPSA92	.22	.20
MPSA93	.22	.20	SC1410	.85	.75
BU126	1.50	1.25	BUX30	2.50	2.20
BU208	2.50	2.20	2SD350	2.50	2.20

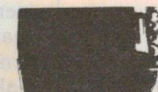
Plus 32 1/2% tax where applicable



## FANS

Cat.	1-99	10+	100+
T12461 240V 4 1/2"	10.50	10.00	8.00
T12465 240V 3 1/2"	10.50	10.00	8.00
T12463 115V 4 1/2"	10.50	10.00	8.00
T12467 115V 3 1/2"	10.50	10.00	8.00

Plus 20% tax where applicable



## SEALED LEAD ACID BATTERY 12V 1.2 AH

S15061	1-99	10-99	100+
	12.50	11.00	10.50

## NICADS

Cat No.	1-99	100+	250+
S15020 AA	1.60	1.50	1.40
S15021 C 1.8AH	3.25	2.90	2.80
S15022 D 4.0AH	5.90	5.50	5.20

Plus 20% tax where applicable

## DIP SWITCHES

S13402 2 Way	10+	100+	1000+
	.70	.65	.60
S13404 4 Way	.80	.75	.70
S13405 5 Way	.90	.85	.80
S13407 7 Way	1.10	1.00	.95
S13408 8 Way	1.20	1.10	1.00

20% Sales tax where applicable



## IBM ADD ON HARD DISK

- 10 Mbyte
- Seagate hard disk
- Hard disk controller by Xebec Cat. X20010

Plus 20% tax where applicable

\$1295

## RELAYS

Massive 3A connectors

S.P.D.T. Cat.	1-9	10+	100+
S14060	\$1.20	\$1.10	\$0.90
D.P.D.T. Cat.	S14061	\$1.50	\$1.40
		\$1.20	



## 75OHM COAX CABLE

Cat No.	100M	500M	1000M
W11222 3C2V	18.00	17.00	16.00
W11224 5C2V	27.00	25.00	24.00

(5C2V WHITE OR BLACK)

100M ROLLS

LINE LOSS PER 100' (33M 200MHz)

W11222 6.2dB (Approx)

W11224 3.9dB (Approx)

Plus 20% tax where applicable

## TELEPHONE CABLE

W11302	2 Pair	1-9	10+
		22.00	21.00
W11303	3 Pair	34.00	32.00
W11310	10 Pair	120.00	115.00

Per 200m Roll

20% Sales tax where applicable



## GREY FLAT RIBBON CABLE

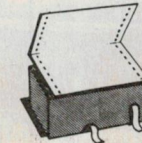
Cat No.	Desc.	Per Mtr 1-3	4-9	10-99	100+
W12614	14 Way	1.29	19.50	18.50	14.00
W12616	16 Way	1.90	21.50	19.50	16.00
W12620	20 Way	2.20	29.50	28.00	20.00
W12625	25 Way	2.50	32.50	29.00	25.00
W12626	26 Way	2.60	34.00	32.00	26.00
W12634	34 Way	2.80	44.00	42.00	34.00
W12636	36 Way	3.00	49.00	47.00	36.00
W12640	40 Way	3.20	55.00	52.50	40.00
W12650	50 Way	3.75	62.00	59.50	50.00

EX STOCK  
LARGER QUANTITIES NEGOTIABLE  
Plus 20% tax where applicable

## COMPUTER RIBBONS TO SUIT CP80, BX80, DP80 ETC.

C22036	3-24	25-99	100+
	7.00	6.50	6.00

Plus 20% tax where applicable



## PRINTER PAPER 60gsm 2000 Sheets 11 x 9 1/2"

1-3	4-9	10+
25.00	22.00	21.00

Plus 20% tax where applicable



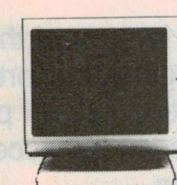
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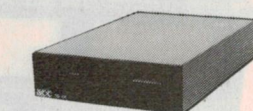
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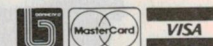
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# THE CROWD PLEASER!

## YAESU FT 726R VHF/UHF transceiver

The best feature of the FT 726R transceiver is its ability to handle band congestion. Fortunately or unfortunately in Australia that's probably the least of problems. So that leaves its new compact modular style, its accessible design, its multimode capabilities . . .

**Peter D. Williams**

*Peter Williams is director of Associated Calibration Laboratories in Melbourne.*

IT WAS SOMETHING of a surprise to read the supporting information that came with the 726R transceiver — a surprise in that you don't have to be away long from the amateur scene to find out that manufacturers take but a few microseconds to make quantum leaps in innovative operating capabilities.

This new receiver consists of a main unit covering the 2 metre band with 6 metre, 70 cm and satellite add-in options. Its real innovation lies in how these modules are packaged. Instead of adding a 2 metre converter to an HF transceiver, or hooking up separate 2 metre, 6 metre or 70 cm transverters with all the connections, conversions setting changes and room that takes, Yaesu has manufactured a neat multimode unit which operates at the 2 metre band with all conversions to other bands matched for in-

sertion into the main unit (see photograph).

To acquire one of these boxes you will be putting off the new car for another six months! Adding the figures per the Dick Smith pricing stickers we end up with a total of \$2138. The basic FT 726R with 2 metre module comes at \$1299, and the other three converters/transverters total \$839. If you are that seriously minded about bands other than 2 metres, it might prove worthwhile checking around for discrete modules.

But this is a serious, high performance rig with features that place it in the 'state of the art' league with the best of current HF radios so let's look a little closer.

### Design and features

As befits an expensive unit the packing is exemplary — all pieces are sealed and the

transceiver itself is packed in a double thickness carton with the auxiliary modules wrapped in foam with the connecting pins well protected against damage.

Installation of the modules could not have been made easier. There is no chance of incorrectly inserting pins or plugs. The modules fit neatly into the transceiver unit after removing the top cover.

Not having seen the inside of any Yaesu equipment for some years, we were impressed with the standard of construction — both mechanical and electrical. Notwithstanding that one would expect improvements in construction over seven or eight years, the layout is clean and open, components are clearly labelled and well shielded making the transceiver accessible for trouble shooting. The operating manual and technical manual give all the information required for understanding and servicing — parts list, voltages and layout are excellent, as is the English.

The rig basically consists of a 10.81 MHz IF box with transverters for each band.

When using the satellite band, the transmit intermediate frequency is 10.7 MHz. The receiver IF stays at 10.81 MHz to allow full duplex operation on this band.

There are a few features of the circuit to note. Each module uses diodes to determine step and tuning size for each band. The diodes are read by the microprocessor, which decides which band can be selected.

Each transverter module has its own PLL to provide RX and TX frequencies in 100 kHz steps, while the 20 Hz steps (an excellent figure for resolution) are provided by the main unit variable frequency oscillator (VFO), common to all modules.

Precise, noise free tuning, which is sometimes lacking in amateur receivers, has been achieved by using high reference frequencies in the PLL to provide a fast settling



The front ends of all transverter modules use dual gate FETs, and in the 6 and 2 metre units, varicap tuning is employed to sharpen up front end responses.

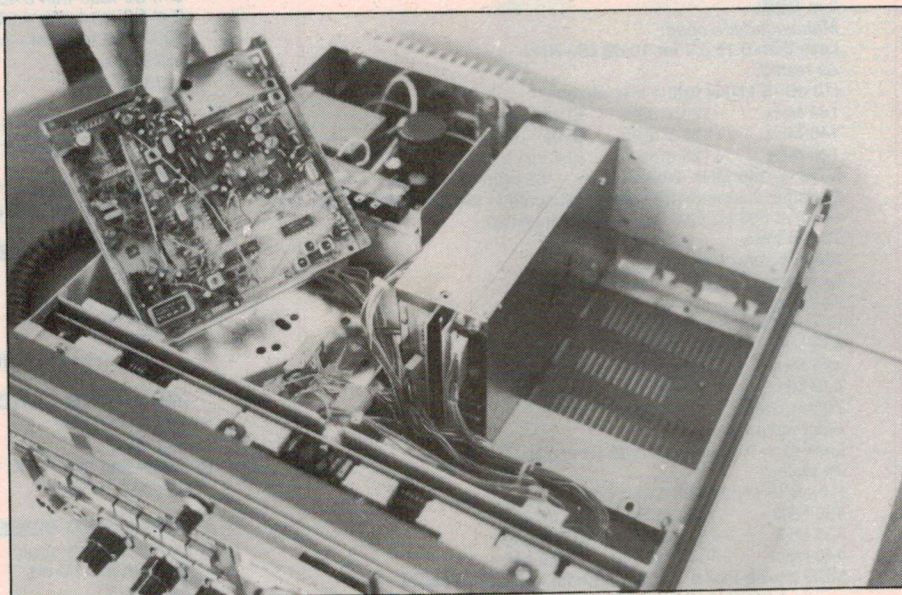
## Operating features

The resolution of the readout is only 100 Hz in any mode, and the display will only change to the next 100 Hz step after five 'clicks' of the FM CHANNEL/CLARIFIER. The word 'click' is appropriate to this tuning function as it adequately describes the detent action of the knob.

All the above tuning features extend and apply to the second VFO as well. This second VFO is used to provide the second operating frequency within the same band or another band for full duplex operation. With the satellite option installed, only one frequency is displayed, that is, either the transmit or receive frequency, but either can be shown depending on the setting of the satellite knobs.

**Block diagram of the transceiver and modules.**

**Block diagram** of the transceiver and modules.



transmit 2 metre FM and receive 70 cm side band providing of course, the other operator has an FT 726 or similar rig with these independent capabilities.

Memories 0 and 1 are used for band limits to scan only a portion of the band. For arm-chair tuning, the microphone supplied can be used to initiate tuning either up or down the band. Scanning is activated by pressing the direction button twice and is stopped by pressing the opposite direction button once. A priority channel is also accessible and is checked during any process every five seconds.

All the above, plus what can be done with repeaters would be the fiddlers delight, particularly in countries with amateurs wall to wall! Any conceivable offset can be used as well as the standards for VHF and UHF. Offsets may be programmed up to 9,999.9 MHz and are stored in a non-volatile memory, along with the stored channels; repeater reverse at the touch of a button keeps repeater 'sore heads' quiet if it can be seen that simplex communication is possible.

Pirates are definitely not catered for, as it is not possible to operate outside the amateur bands. Trying to pirate by operating a positive shift brings "E" up on the display

## LABORATORY TEST FIGURES

YAESU FT 726R S/N 4D11033 with 6 m, 2 m, 70 cm and satellite modules

### RECEIVER SENSITIVITY

#### 6 m FM:

*Manufacturer's spec:*

Less than 0.25  $\mu$ V for 12 dB SINAD

*As tested:*

(3 kHz deviation 12 dB SINAD)

50 MHz -120.6 dBm (0.21  $\mu$ V)

52 MHz -120.8 dBm (0.20  $\mu$ V)

54 MHz -118.7 dBm (0.26  $\mu$ V)

#### 6 m SSB:

*Manufacturer's spec:*

Less than 0.15  $\mu$ V for 10 dB (S+N)/N

*As tested:*

(10 dB (S+N)/N with 1 kHz offset)

50 MHz -126.7 dBm (0.1  $\mu$ V)

52 MHz -127.2 dBm (0.098  $\mu$ V)

54 MHz -125.6 dBm (0.12  $\mu$ V)

MDS @ 52 MHz (Noise Floor) -132.3 dBm for 3 dB (S+N)/N

#### 2 m FM:

*Manufacturer's spec:*

Less than 0.25  $\mu$ V for 12 dB SINAD

*As tested:*

(3 kHz deviation, 12 dB SINAD)

144 MHz -120.1 dBm (0.22  $\mu$ V)

146 MHz -121.1 dBm (0.2  $\mu$ V)

148 MHz -121.0 dBm (0.2  $\mu$ V)

#### 2 m SSB:

*Manufacturer's spec:*

Less than 0.15  $\mu$ V for 10 dB (S+N)/N

*As tested:*

(10 dB (S+N)/N with 1 kHz offset)

144 MHz -125.7 dBm (0.12  $\mu$ V)

146 MHz -128.5 dBm (0.084  $\mu$ V)

148 MHz -125.8 dBm (0.12  $\mu$ V)

MDS @ 146 MHz (Noise Floor) -132 dBm (0.054  $\mu$ V)

Dynamic characteristics were measured in the side band mode. The optional 600 Hz CW filter was not installed.

#### 70 cm FM:

*Manufacturer's spec:*

Less than 0.20  $\mu$ V for 12 dB SINAD

*As tested:*

(3 kHz deviation, 12 dB SINAD)

430 MHz -121.9 dBm (0.18  $\mu$ V)

435 MHz -122.4 dBm (0.17  $\mu$ V)

440 MHz -122.8 dBm (0.16  $\mu$ V)

#### 70 cm SSB:

*Manufacturer's spec:*

Less than 0.15  $\mu$ V for 12 dB (S+N)/N

*As tested:*

(10 dB (S+N)/N with 1 kHz offset)

430 MHz -130.2 dBm (0.069  $\mu$ V)

435 MHz -131.7 dBm (0.058  $\mu$ V)

440 MHz -131.3 dBm (0.063  $\mu$ V)

MDS (Noise Floor) -135.3 dBm for -12 dB (S+N)/N

### IMAGE REJECTION

*Manufacturer's spec:*

Better than -60 dB

*As tested:*

Image @ 52 MHz = 30.38 MHz was 88 dB

Image @ 146 MHz = 124.38 MHz was 73 dB

Image @ 435 MHz = 299.7710 MHz was 88 dB

### IF RESPONSE — immeasurable

### SQUELCH SENSITIVITY

(No spec given)

Min with TX just muted 0.087  $\mu$ V

Max with control full on 0.55  $\mu$ V

### BLOCKING (Dynamic Range)

(No spec given)

Measurement taken with blocking signal 20 kHz removed:

6 m, -123 dB; 2 m, -101 dB; 70 cm, -102 dB

### IMD (Dynamic Range)

(No spec given)

6 m, -88 dB; 2 m, -90 dB; 70 cms, -94 dB

### THIRD ORDER INTERCEPT POINT

(No spec given)

6 m, 0 dBm; 2 m, +3 dBm; 70 cm, +5 dBm

### AUDIO FREQUENCY RESPONSE

-3 dB @ 230 Hz and 2610 Hz with -12 dB/octave roll off.  
There is a +5 dB rise at approximately 300 Hz.

### AUDIO OUTPUT

*Manufacturer's spec:*

10% distortion at 1.5 W

*As tested:*

2.3% distortion at 100 mW total through rf system

10% distortion at 1.5 W

### RECEIVER RADIATION (antenna socket)

(No spec given)

6 m, -78 dBm; 2 m, -64 dBm; 70 cm, -54 dBm

### DISCRIMINATOR METER

Applying signal  $\pm$  10 kHz from tuned frequency, meter deflection to LHS was full scale. Meter deflection for corresponding frequency shift in other direction was half scale.

### "S" METER READINGS

*IARU spec:*

S9 = 100  $\mu$ Vemf = 50.0  $\mu$ Vpd = -73 dBm

*As tested:*

(SSB Mode)

6 m S9 read with 6.48  $\mu$ Vemf = 3.24  $\mu$ Vpd = -96.8 dBm

2 m S9 read with 4.58  $\mu$ Vemf = 2.29  $\mu$ Vpd = -98.8 dBm

70 cm S9 read with 2.2  $\mu$ Vemf = 1.1  $\mu$ Vpd = -106 dBm

*IARU spec:*

6 dB/"S" point

*As tested:*

3 dB/"S"  $\pm$  0.5 dB — in SSB mode.

In FM mode, S meter is approximately linear but has expanded centre scale.

At low end is 9 dB/"S" point, 0.6 dB/"S" point at centre, 3 dB between S9 + 40 and S9 + 60 due in part to the limiting action of the receiver.

### CARRIER SUPPRESSION

**USB/LSB**

*Manufacturer's spec:*

better than -40 dB

*As tested:*

-60 dBc (146 MHz) either side band

### INTERMODULATION

(No spec given)

*As tested:*

2 tone test at 2.7 and 1.2 kHz

-32 dBc for 2 m; -29 dBc for 6 m; -33 dBc for 70 cm

### UNWANTED SIDEBAND

*Manufacturer's spec:*

better than -60 dBc

*As tested:*

-65 dBc at 2 m

### SPURIOUS AND HARMONICS

*Manufacturer's spec:*

better than -60 dB

*As tested:*

FM/SSB mode results identical

Frequency of test 2 m 146 MHz

Spurious 3 kHz from carrier -65 dBc

Spurious 10 kHz from carrier -65 dBc

First harmonic -65 dBc

Second harmonic < -70 dBc

### TEMPERATURE EFFECT from ambient of 10°C

RX: after 2 hours, 32°C

TX: after 1/2 hour, 61°C. Power output dropped from 12 W to 10 W at 146 MHz;

Test not conducted on other bands

### POWER OUTPUT FM

6 m band 12 W

2 m band 13 W

70 cm band 12 W

### STABILITY

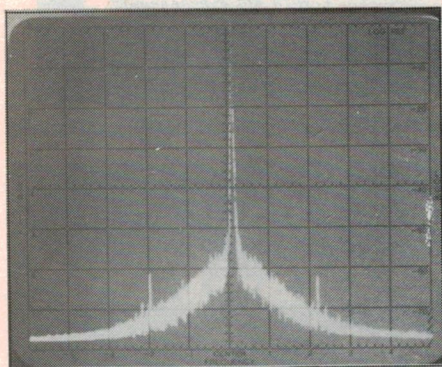
After turn on, drift in first half hour was 570 Hz equivalent to +4 ppm at 146 MHz. (Manufacturer's spec  $\pm$  10 ppm.)

### POWER SUPPLIES

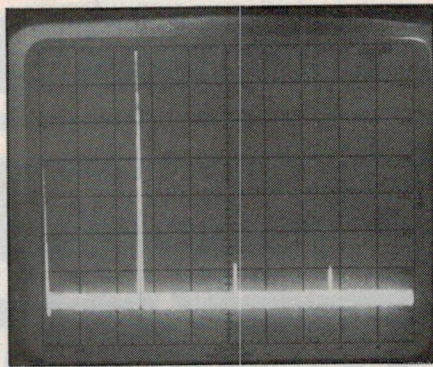
Operates on 240 Vac or 12 Vdc



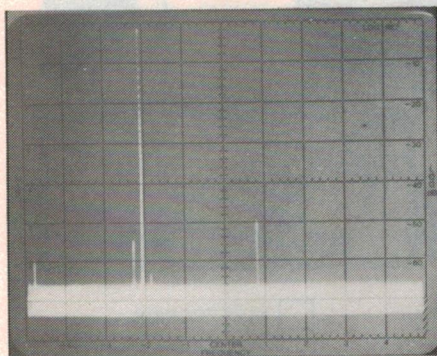
The FT 726R with satellite module (left), and 6 m and 70 cm modules ready for installation.



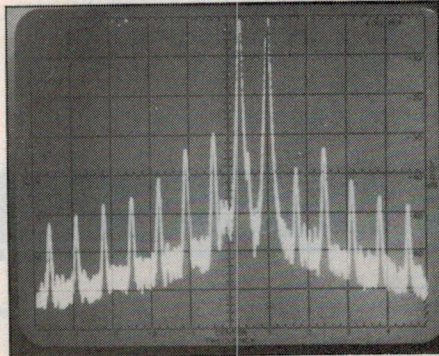
**Spectral display** at 146 MHz carrier FM at full output. Note spurs at 10 kHz from carrier. Vertical scale 10 dB per division.



**Spectral display** at 52 Hz showing harmonics at 104 MHz and 156 MHz at approximately 73 dB<sub>c</sub>. Fundamental reduced 15 dB. 20 MHz per division frequency span.



**Spectral display** at 146 MHz showing harmonics at 292 MHz at 65 dB<sub>c</sub>. Fundamental reduced 15 dB. Note minor spurs close to carrier at 70 dB<sub>c</sub>, removed by 20 MHz.



**Spectral display** for two tone IMD tests; 900 Hz and 2.2 kHz. Power output: 10 watts. Test frequency: 146 MHz. Spectrum analyzer setting: 100 Hz resolution, 2 kHz per division frequency span, 10 dB per division vertical. Third order products are approximately 30 dB down. AGC was just on the point of overdrive.

and all functions are inhibited until the error is corrected.

Equipment of this type really shows its colours in crowded band conditions, (fortunately a problem hardly likely in Australia). To this end SSB and CW modes have IF shift and bandwidth controls to effectively remove interfering signals through IF pass-band shifting.

Automatic gain control action (selectable) is excellent and its speed is of value on CW or SSB to follow a signal with flutter.

Two meters indicate received signal strength and rf power. The signal strength metre works in both full duplex and semi-duplex mode during which it provides an indication of relative automatic level control. The rf power meter which gives a rather pessimistic indication of levels, also performs as a discriminator during reception, and on full duplex, it can be switched to indicate automatic level control, power output and discriminator.

We were impressed with the possibilities of the satellite IF unit, and have already commented on its full duplex cross band potential. It is a simple matter to put one VFO on the 435 MHz uplink and the other VFO on the 145 MHz downlink. Although satellite operation was not attempted, cross-band full duplex was perfectly satisfactory, although two rigs were required.

## General comments

For within the price range of \$2138 all up, the rig provides all the performance one could wish to satisfy a fervent interest in VHF/UHF. For the amateur who has nearly everything, the 726R will round out his ability to frustrate band watchers monitoring private channels for interesting items of scandal — especially when using full duplex, crossband!

The noise blanket was not particularly effective, but what is?

A myriad of features and operating variations seems daunting but the clear operating instructions pay off with user familiarity.

Few operators in Australia will probably achieve the full potential offered by the FT-726R. In Japan, USA or Europe, where crowded operating conditions and opportunities to reach its potential exist, it would be a cost effective rig.

Technically, the transceiver could be classed as very good relative to our criteria, (see page 102) in all major areas of concern — the receiver is 'hot' but probably not up to the performance of a separate, well engineered converter into a receiver with low reciprocal mixing.

But if you are considering operating on bands other than 2 metres, you should check this versatile box. We couldn't really find that much to fault subjectively or objectively. Well worth the taxation refund if VHF/UHF turns you on.

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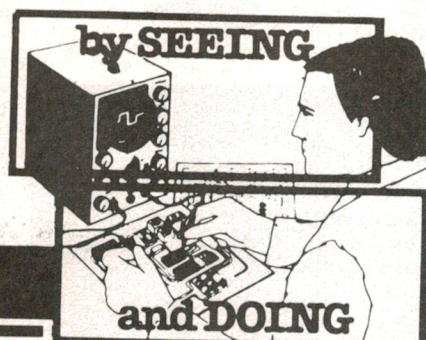
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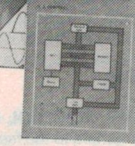
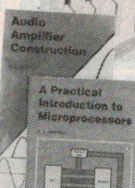
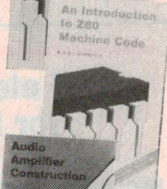
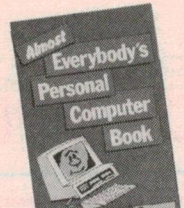
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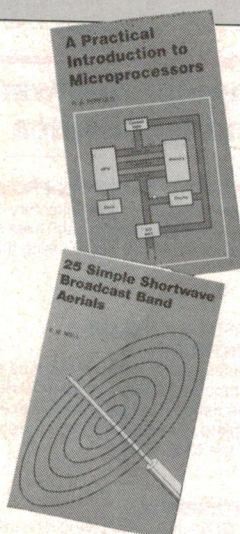
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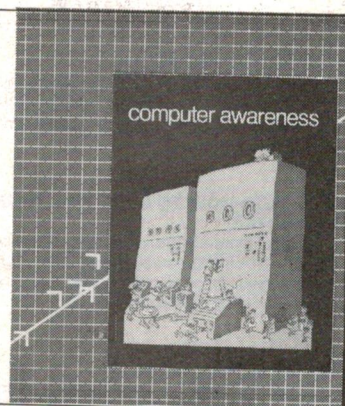
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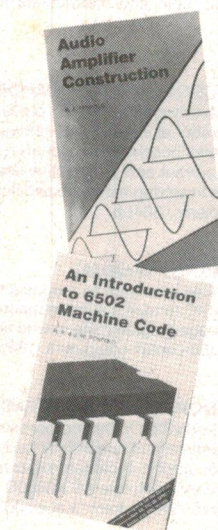
■ The vast increase in running speed obtained when writing programs in machine code is offset, to a degree, by the added complexity in writing them. However, it is not as difficult as one might think and this book tells the story.

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# GETTING STARTED ON THE HIGHER FREQUENCIES

Arthur Cushen

Voice of America and the BBC have long been heard around the world but broadcasters from the unlikeliest places are these days saying something on shortwave. This article is designed to help the beginner in this field get through the jumble of noise from his receiver to an identifiable broadcast that will fire his interest in the hobby of shortwave listening.

THE WIDE RANGE of shortwave receivers available, the ease of finding the exact frequency and the portability of the modern receiver has introduced radio listening as a hobby to a wide range of listeners in all age groups.

Teenagers are finding a new world at their fingertips. Many who have retired from business have recollections of radio listening in the 1930s, and now take pleasure in the radio listening hobby and the mystery of voices from distant lands.

The mail that pours into my letterbox from listeners in New Zealand, Australia and the South Pacific who are taking up the radio listening hobby, makes it obvious that

two things are deterring them from fully understanding this interesting pastime: they find frequencies sometimes a little difficult to determine and the world time systems confusing.

The typical query I receive is "what is meant by 'SW1' and 'SW2' and the figures on the dial like '8', '9', '10', '11' and '12'?" etc. In answer, the shortwave band 1 (SW1) generally covers the tropical bands on most of the portable receivers. Shortwave band 2 covers the higher frequency bands. The tropical band consists of the frequencies from 1600 kHz to 6000 kHz set aside for use by stations in the tropics exclusively. In the tropics, noise level is so high

on the ordinary commercial bands that stations there have to make use of part of the SW bands.

## Establishing frequencies

In the early listening days, it was necessary to know every station on the dial and mark it because calibration was so poor (despite the huge dials).

Some ingenious attempts were made to overcome this problem but by far the most important was the technique of bandspreading. Receivers manufactured with bandspreading provided separate band selection by means of a button or switch, which could then be further tuned by the (still congested) shortwave dial. Today's new receivers give accurate frequency digitally but a ghost of the problem exists today for many of the newer listeners, particularly the younger ones taking up radio listening, and using portable transistor receivers which are poorly calibrated.

If you have such a receiver you should mark the dial according to its megahertz divisions 8, 9, 10, 11 and 12. Then you can find a station like the BBC which broadcasts on 11750 kHz or 11.75 MHz three quarters the way between 11 and 12 on the shortwave dial. Once the listener becomes familiar with positions on the radio dial and where he can find known stations, then the finding of other unknown stations becomes a little easier.

The modern receiver has also had facilities added for the blind radio listener and introduction of a voice chip enables the digital read-out to be converted to voice at the press of a button. (The Icom IC-R71 has this facility.)

Most receivers are now marked in megahertz or kilohertz but the older receivers were marked in metres (or wave length) so some comparison between the two systems is needed. Stations in particular metre bands operate as follows:

- 11 metre band: 256000-26100 kHz
- 13 metre band: 21450-21750 kHz
- 16 metre band: 17700-17900 kHz



19 metre band: 15100-15450 kHz  
 25 metre band: 11700-11975 kHz  
 31 metre band: 9500- 9775 kHz  
 41 metre band: 7100- 7300 kHz  
 49 metre band: 5950- 6200 kHz

The 1979 World Administrative Radio Conference has increased the width of the majority of these bands. Stations are gradually moving outside these frequency ranges (sometimes carelessly) to avoid interference. Already noticeable is the increase in the 31 metre band with stations moving up to 10000 kHz, 25 metre band with the expansion 11650-11700 and 11975-12050 kHz. The 19 metre band 15450-15600, and the 16 metre band, 17550-17700 kHz are gradually coming into use. The 13 metre band is being extended from 21750-21850 kHz while the 11 metre band has had a slight reduction. A new band has been established between 13600-13800 kHz, and this band is already being used by some countries.

### Calculating times

The newcomer to shortwave radio keenly tuning his radio to the sought after broadcast but with no apparent success might conclude his receiver is inadequate (or question his ear); but there is a host of other variables. Ionospheric conditions may have changed, stations may have changed frequencies, prevailing sunspots may have wiped out signals on that band. But first and foremost, to catch the desired broadcast you need to understand the time system used by broadcasters.

The 24 hour clock system, based on Greenwich Mean Time (GMT), will be familiar to most people. Since 1884, when most countries (with international commitments) adopted GMT, the globe has been divided into arbitrary but consecutive time zones starting with the Greenwich meridian and going east. Crossing from one time zone into another you wind you clock backwards or forwards as required by the convention. The international date line, running through the Pacific and the least populated areas to avoid confusion, marks the crossing from one day into the next while still remaining in the same time zone. Sounds confusing? Well consult the accompanying map which should make things a little clearer.

UTC (or Universal Time Co-ordinated) is the current standard time zoning system but really marks only a change in the methods of measuring time absolutely. Previously with the GMT standard, time calculations were made from positions of the sun and stars; now it is measured atomically giving a more accurate reading. The change to all intents and purposes is a change in name only.

Programming and time signals on shortwave broadcasts are given in UTC, all based on the Greenwich meridian. When inter-



The Sony ICF6800W is regarded by most mediumwave listeners as one of the best receivers in its class on the market for selective listening.



A typical transistron receiver, covering shortwave would be used by the newcomer to the hobby. Understanding the dial calibration is essential when locating stations.

preting a time, you first need to determine the contemporary UTC time for your area, then you need to translate from UTC to the local 12 hour clock. The accompanying map shows the time divisions and periods you have to add to Greenwich to get your local UTC time. For example, the time 0005 UTC in Greenwich means 1005 in Sydney, which translates to 10.05 am. When it is 1305 UTC in Greenwich it is 2305 or 11.05 pm in Sydney; 1005 (2505 less the 24 hours constituting one day) or 1.05 am the next day in Auckland; and 5003 or 5.05 am the previous day in Los Angeles. Take care to account for crossing the international date line and any local summer time in your area.

### Tune to English broadcasts

Many beginners to shortwave listening write to me asking identification of the sta-

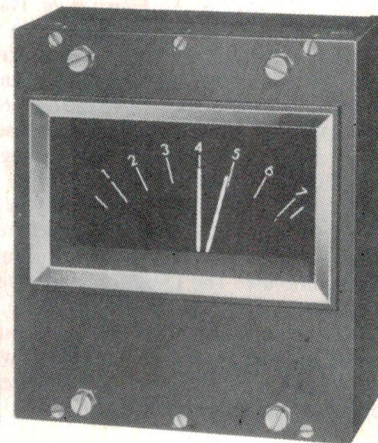
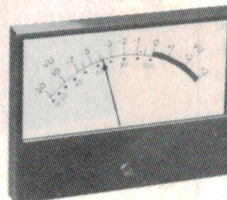
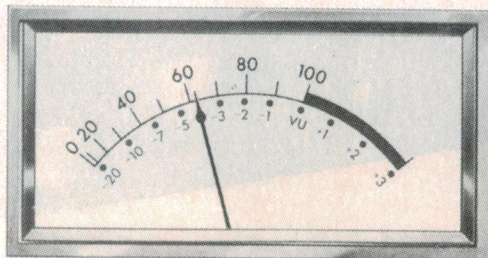
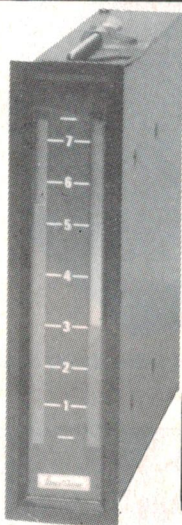
tion they heard broadcasting at a certain frequency at a certain time, but this is particularly difficult if it was a foreign language broadcast. Often the hobbyist cannot identify the language and his knowledge of frequencies is still a little indeterminate. (It is even more frustrating if it relies on identification by the foreign language broadcaster.)

I would like to encourage hobbyists to begin listening to English broadcasts (or those in their own languages) then gradually move to broadcasts in other languages that they can identify.

There are plenty of English broadcasts on shortwave and if verification of reception is the idea behind the new listener's move into shortwave listening, then these are the stations which he or she should concentrate on for several weeks until adequately conversant with the sounds of other languages.

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## Whoops . . .

Our apologies to Applied Technology Pty Ltd for several errors which came to light after the **Focus on Microbee** supplement in this issue went to press:

- ★ Australian Microcomputer Promotions, 265a Springvale Rd, Glen Waverley 3150 Vic. (03-233 9665), was omitted from the list of Authorised Microbee Support Centres on page 14. The Hawthorn, Vic, Microbee Technology Centre has been replaced by the Deepdene Centre, although both are shown.
- ★ The price of the Beemodem on page 25 should be \$189.50. Also, the Beemodem will operate at 300 AND 1200/75 baud.
- ★ The DSY-120 Letter Quality Wheel Printer shown on page 25 has been reduced in price to \$399.00.

We sincerely regret any inconvenience these errors may have caused.

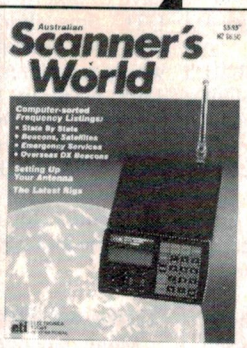
## GET AMONGST THE ACTION!

Australian SCANNER'S WORLD is the book that will introduce you to that other world 'beyond the shortwaves'. It contains an introduction to scanning and scanners, an article on scanner antennas — including how to build and to erect antennas. The major part of this book is the "Listener's Guide"; computer-sorted listings of services throughout Australia and New Zealand, with their frequencies listed in both frequency order and alphabetical order by service. Beacons are listed also. Your copy is available by mail order direct from:

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This English Ekco receiver gave the writer the grounding in radio listening, as the calibration was limited and one had to judge frequencies by checking against known signals.

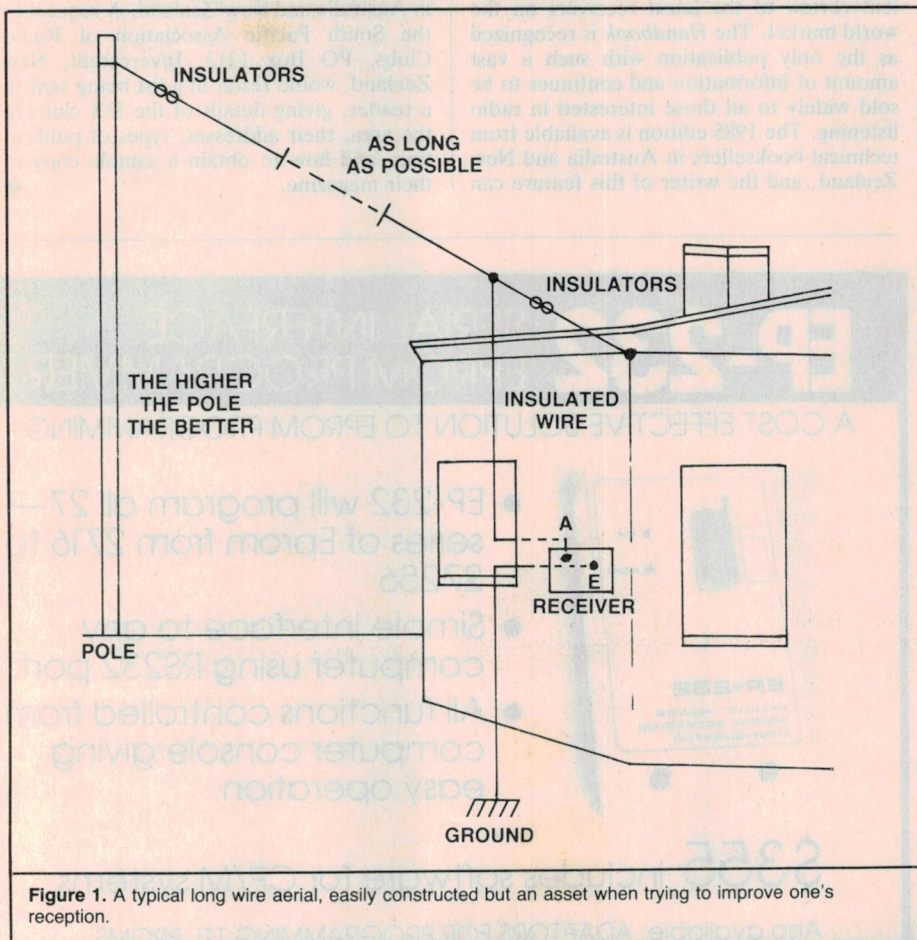


Figure 1. A typical long wire aerial, easily constructed but an asset when trying to improve one's reception.

## Seasonal changes

International broadcasters make seasonal adjustments to their frequencies and schedules four times a year on the first Sunday of March, May, September and November.

Some stations do not make changes in March or September on the first Sunday, but adjust their schedules on the last Sunday of those months as countries in the

northern hemisphere move into daylight time, and in September return to standard time.

These frequency changes are dictated by the changes in seasons which affect reception. In November and May the major changes occur to account for the changed summer and winter seasons.

Adjustments to daylight time do not af-

fect listeners in the South Pacific as most international broadcasters (such as the BBC, VOA and Radio Australia) continue their schedule on UTC time. Radio New Zealand however, which relays the domestic service that is heard one hour earlier in Australia, between the last Sunday in October and the first Sunday in March will make reference to domestic summer time as will some European stations.

Generally speaking, signals from Europe will be better after dark during our summer and during daylight hours in winter. The lower frequencies below the 49 metre band, known as the tropical bands, are not subject to seasonal changes because stations on these frequencies are generally relaying a medium-wave service. This is the case in Central and South America, Africa and Asia, and stations in the Pacific which are heard in the tropical bands. These are between 4750-5050 kHz (60 metres); 3900-3995 (75 metres), 3200-3400 kHz (90 metres) and 2350-2490 kHz (120 metres). Reception on these lower frequencies is only possible during the hours of darkness in the area between the transmitter and your receiver, though there is a period of reception at dusk and dawn which allows signals to be received.

## Aerials

The modern portable receiver is generally equipped with a telescopic aerial which gives adequate reception for most local stations, but it is almost essential that an outside aerial be used in order to improve the signal-to-noise ratio on medium and short-wave. The whole idea is, of course, to keep the noise level down and the signal level up so that broadcasts can be understood.

An outside aerial can be a simple inverted L (see Figure 4), the length is not critical. The main thing is to have it as high as possible, away from power lines and clear of any obstruction in the vicinity. The wire between the two insulators can be copper or covered wire, but the lead in should be covered wire. Make certain that it does not touch any metal objects between the aerial and your receiver. It is wise to fit a lightning arrester to ensure that your equipment is safe and free from possible damage from lightning. The arrester short circuits any incoming flash to earth thus protecting your receiver.

It should also be remembered that an earth pipe outside the window with the pipe driven into the ground and kept damp enables noise to be greatly reduced. Earthing is another aspect which affects the quality of the signal.

There are many commercial aerials on the market. Some of these are fitted outdoors; others are of the active aerial type which are located close to the receiver. The outdoor type includes a multi-band trap di-



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	Tractor Feeder	Ex Tax \$111.12 Incl Tax \$123.78
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## Publications

There are several publications and booklets which are essential for use by the newcomer to the radio listening hobby. Undoubtedly the *World Radio & Television Handbook* must take pride of place as it contains all the information about radio and television stations. The 39th edition of 600 pages completely updates the information in previous editions. It covers the frequencies, times, languages, addresses and other relevant information on all the world's radio and television stations, as well as an excellent review of the latest receivers on the world market. The *Handbook* is recognized as the only publication with such a vast amount of information and continues to be sold widely to all those interested in radio listening. The 1985 edition is available from technical booksellers in Australia and New Zealand, and the writer of this feature can

supply details on all publications mentioned in this article.

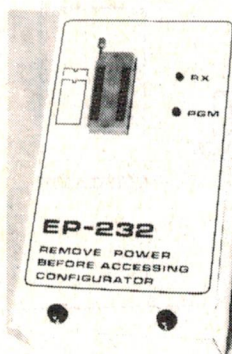
*The World In My Ears* by the author, over 200 pages with 100 illustrations is now sold in 70 countries. This book is available from ETI Book Sales.

A wide variety of books is listed in *Radio Nederland Book List*, which is available free from Radio Nederland, PO Box 222, Hilversum, Holland. This publication covers books, periodicals and magazines, and is the most comprehensive review of printed material for the radio listener. As well, a pamphlet "Receiver Shopping Guide", which surveys the world's receiver market, and an excellent booklet about aerials is available from Radio Nederland.

The new listener might be interested to join a radio club, of which there are several in Australia and New Zealand. A request to the South Pacific Association of Radio Clubs, PO Box 1313, Invercargill, New Zealand, would result in a list being sent to a reader, giving details of the DX clubs in the area, their addresses, types of publication, and how to obtain a sample copy of their magazine.

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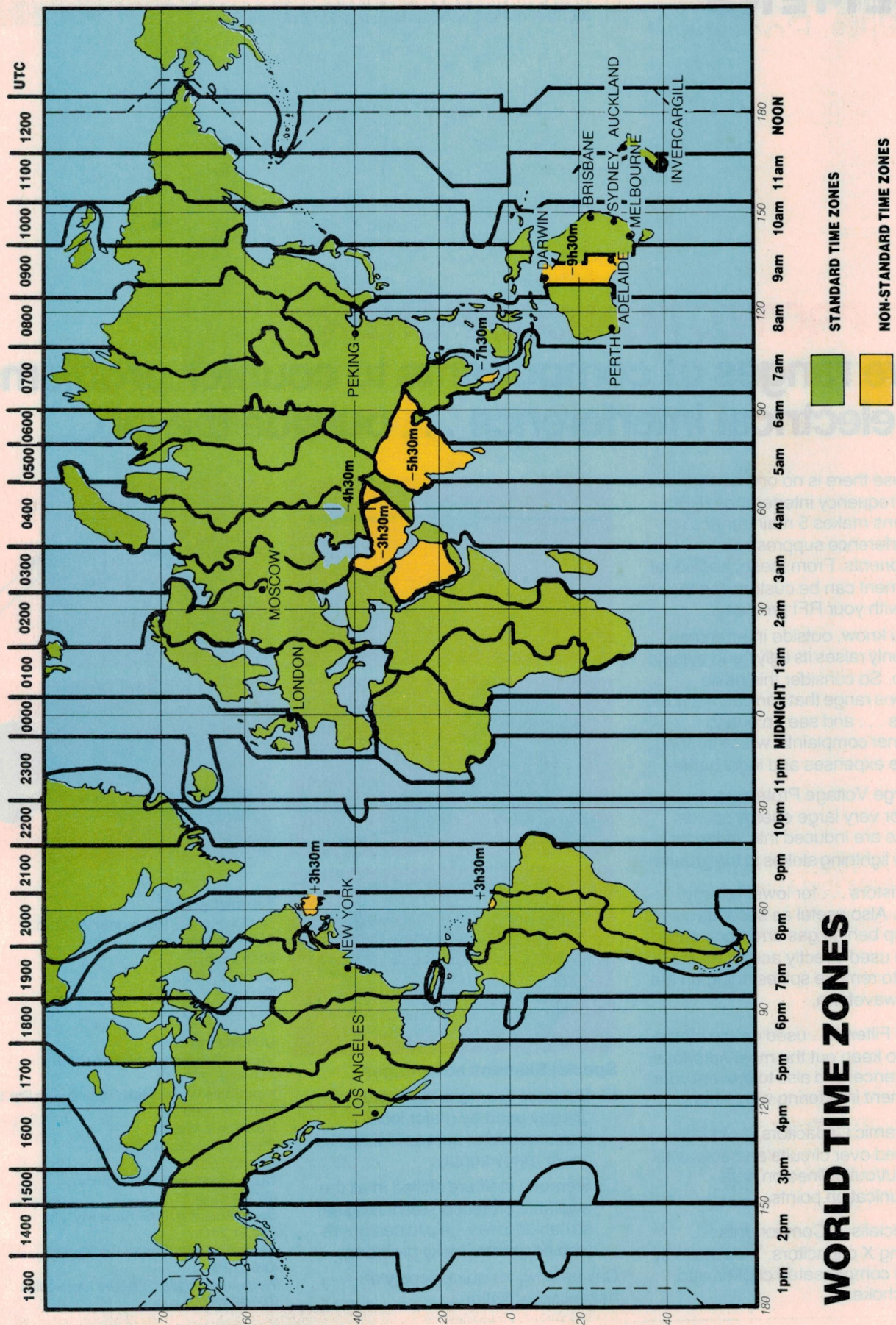
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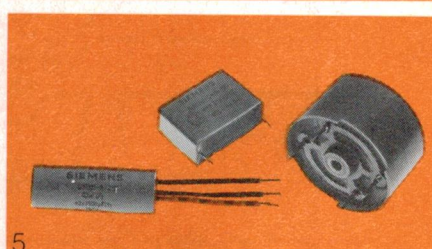
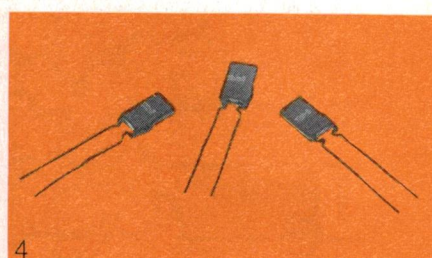
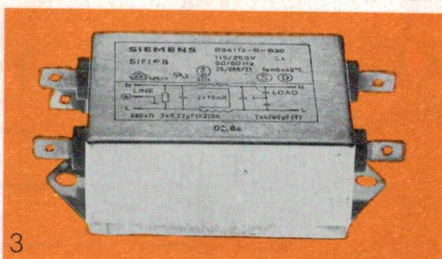
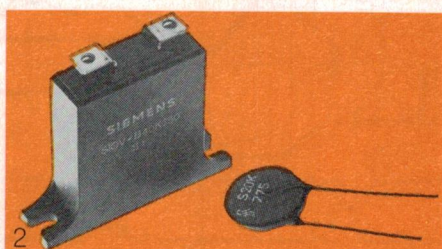
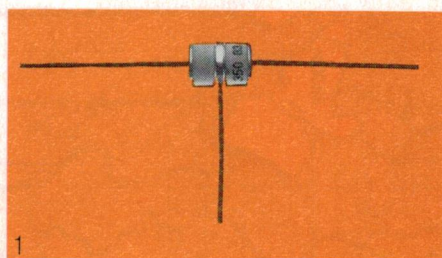
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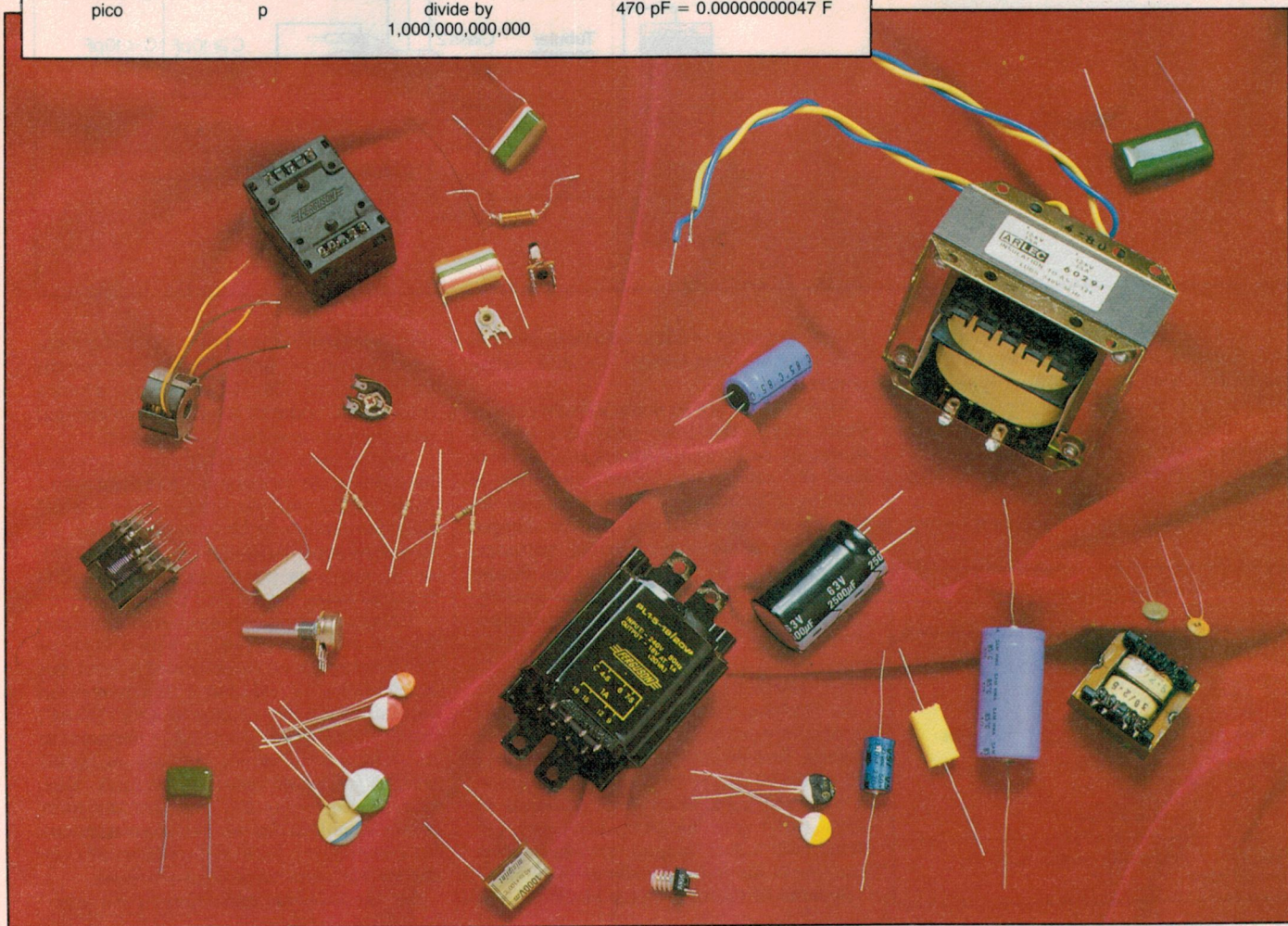
# KNOW YOUR PASSIVE COMPONENTS

Peter Phillips

TABLE 1. TYPICAL MULTIPLIERS USED IN ELECTRONICS

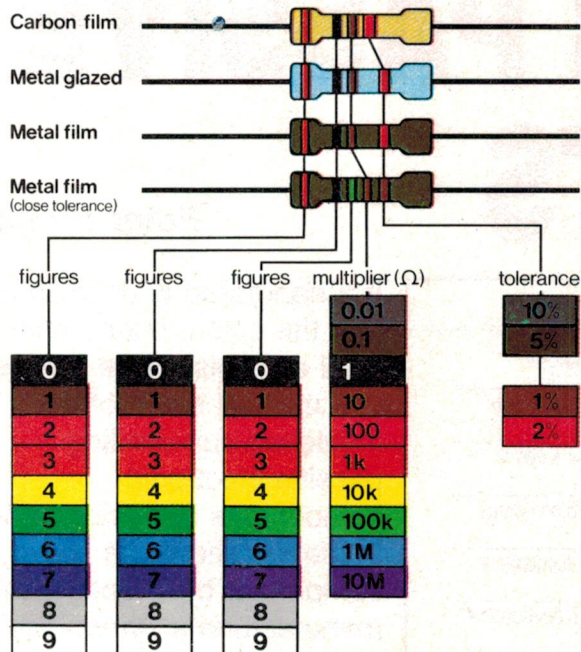
Multiplier name	Symbol	Multiplier's value	Example
Mega	M	multiply by 1,000,000	2M2 = 2,200,000
kilo	k	multiply by 1,000	5 kV = 5,000 V
milli	m	divide by 1,000	3 mA = 0.003 amps
micro	$\mu$	divide by 1,000,000	22 $\mu$ F = 0.000022 F
nano	n	divide by 1,000,000,000	330 nF = 0.00000033 F
pico	p	divide by 1,000,000,000,000	470 pF = 0.00000000047 F

If a nanofarad is unknown and the colour code unclear, read on. This article will help you unravel some of the mysteries surrounding passive electronic components and tell you how to identify the value of a component by decoding the manufacturer's symbology!

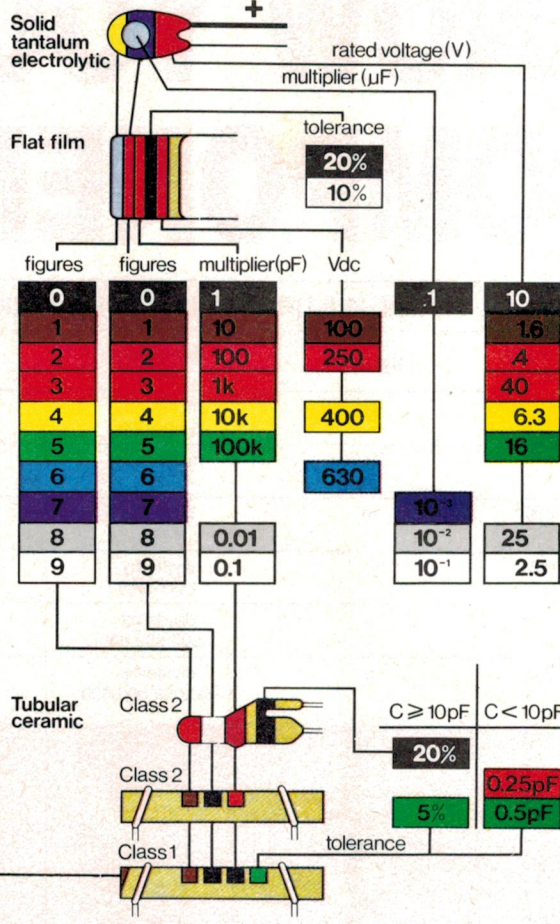


## COLOUR CODES

### Resistors



### Capacitors



WHAT THE HECK is a passive component? If you're a newcomer to the world of electronics, you're probably asking that question right now. The brief answer is it's a component (obviously!) that doesn't require any external source of power in order to do its job. A resistor, a coil, even a piece of wire are all examples of passive components. And they're numerous — in a

typical circuit there could well be as many as 90% passive components to 10% active components.

In fact there are so many passive components that in this issue we'll stick to such things as coils, transformers and how to read the component values, and then in Starting Electronics 7 we'll continue by looking at the remaining passive components such as meter movements, batteries, cabling, indicator lamps and so on. Future parts of the series will examine cabling, plugs and sockets, as well as active components.

### The multiplier

In Starting Electronics 4, resistors and capacitors were discussed with the promise of some further explanation about reading the codes to component values. Resistors, as you will remember, are measured in ohms (after the German physicist, GS Ohm) with values ranging anywhere from fractions of an ohm, to millions of ohms.

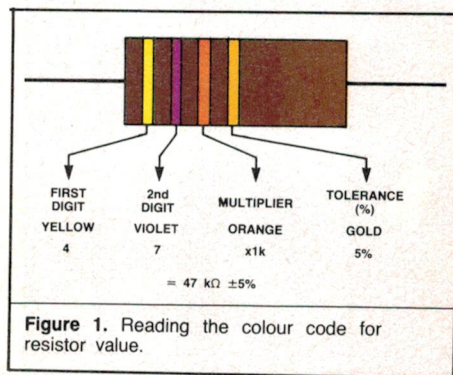
Because of the wide range of values, not

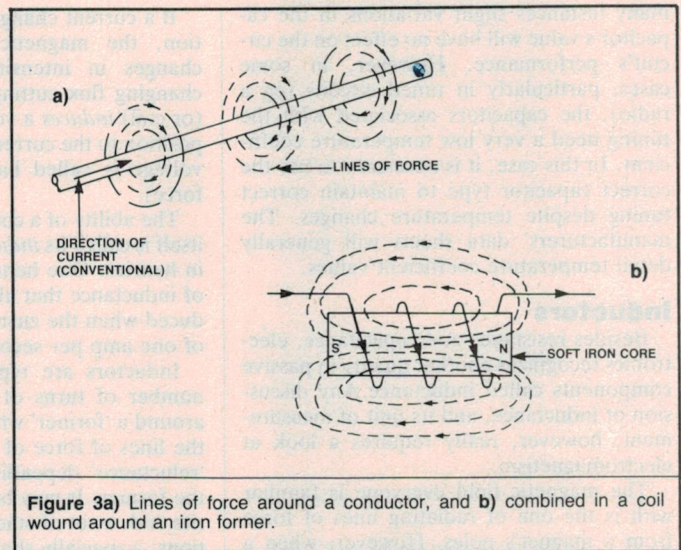
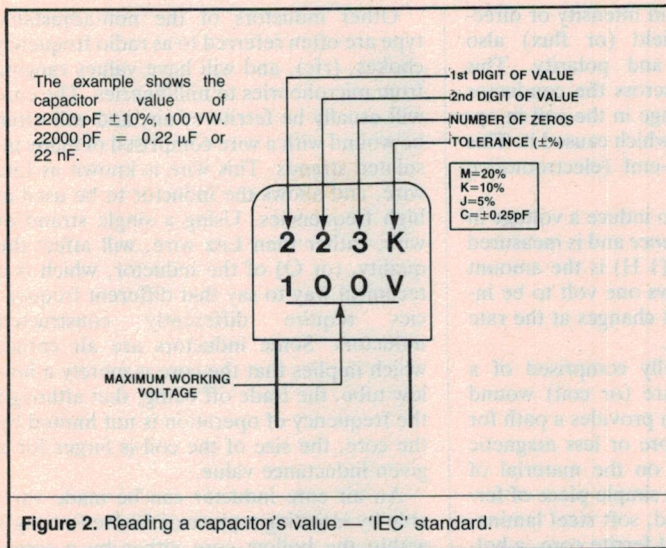
only for ohms but for most electrical quantities, a shorthand form is used to express the various values. This is achieved by including multipliers, some of which will be familiar now that we have been 'metricated'.

Table 1 lists some of the more common multipliers. As an example, a resistor with a value of 2.2 million ohms becomes a 2.2 megohm resistor or, as is standard now, a 2 meg 2 resistor, written as 2M2  $\Omega$ . The 'M' or 'k' replaces the decimal point, the  $\Omega$  (omega) being the symbol for ohms.

Using a multiplier makes sense when you try and ask for a capacitor with a value of 330 thousandths of millionths of a farad. It's much easier to ask for a 330 nanofarad capacitor, and even easier to write 330 nF, rather than 0.00000033 farads. One point to watch is the difference between m (milli) and M (mega or meg). In general, kilo, meg, micro, nano and pico are the most common multipliers to the measurements for components, with milli occasionally occurring for inductance measurements.

So, there's some more 'jargon' for you.





## Reading the value of a resistor

To indicate the value of a resistor, manufacturers mark those with a wattage of 1 watt or less, with a colour code. This convention associates a particular numerical value, multiplier or tolerance with a particular colour and the total value of the resistor is marked by the order of its colour bands. The colours and their values are shown in the chart opposite.

A rather crude mnemonic I grew up with to remember the numerical order of the colours is: Bad Boys Rape Our Young Girls, But Violet Gives Willingly. Not recommended behavior, but at least it helps me remember the order of the colours. (Gerry Hui knows a polite version but you need to know Chinese.)

Figure 1 shows how this colour code is applied to resistors. The order of the bands is read as digit 1, digit 2, number of zeros or multiplier, and tolerance. For example, a resistor with the colours orange, blue, red and gold starting from the band closest to the end of the component reads 3, 6, x 100, 5%. In other words, 3600 ohms (or 3k6) at 5% tolerance.

Notice that the tolerance band is read last. Five per cent (gold band) is a common tolerance. Another useful point is to note the colour of the body of the resistor. The colour usually denotes the type of construction, with beige being a carbon film, light blue being a metal glazed type and olive green being a metal film type.

## Reading the value of a capacitor

The colour code is often, though not always, applied to capacitors. It would be a brave person who would assert that he can identify the value of all capacitors by using the many and varied codes that have been

adopted over the years.

In the case of a flat film capacitor, for example, the bands are read as for a resistor, but the resulting figure is the number of picofarads. If you want this value in microfarads, you must then divide by 1 million, or by 1000 if you want the value in nanofarads. Two further bands give the tolerance and the working voltage of the capacitor. The colour coding arrangement varies between capacitor types, with tantalum capacitors having a dot to represent the multiplier and the value comes out in microfarads.

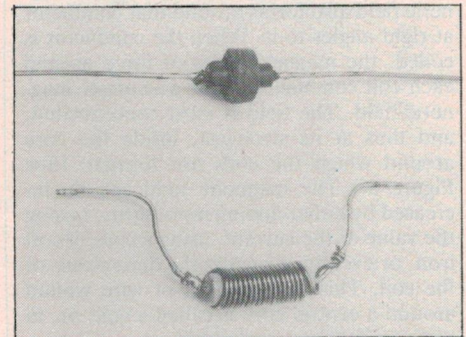
Other standards include the 'IEC' standard, whereby a number is printed on the body of the capacitor. In this case, the first two numbers are the first two digits of the value, the third number is the number of zeros, with a letter (M, K, J or C) representing the tolerance. Again the value will be in picofarads, so further division may be necessary. Figure 2 gives an example.

Sometimes the actual value is printed on the capacitor, which makes life much easier. To help you wade through all these codes look at the colour code chart on page 124. Many parts distributors offer wall charts, or even data sections within their catalogues detailing this type of information. It's indispensable, and the wall charts are often very colourful for adorning the workshop door!

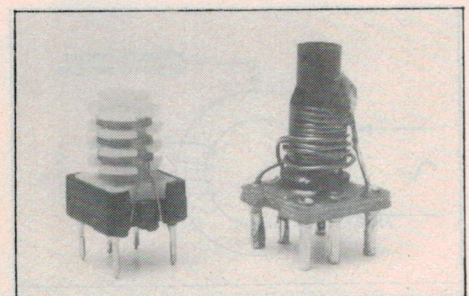
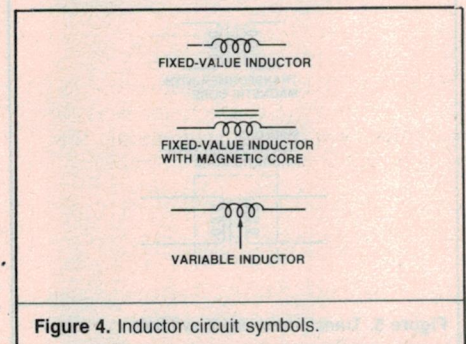
A very useful project would be to build a capacitance meter, as it can save a lot of time and hassle identifying the value of a capacitor.

When using capacitors beware that you take note of the voltage rating marked on the case. This indicates the maximum voltage that the capacitor can safely operate at.

One last word about capacitors is to mention the temperature coefficient. This is simply a way of describing how the value of the component varies with temperature. In



**Fixed inductors.**



**rf type transformers.**

many instances slight variations in the capacitor's value will have no effect on the circuit's performance. However, in some cases, particularly in tuned circuits (eg a radio), the capacitors associated with the tuning need a very low temperature coefficient. In this case, it is necessary to use the correct capacitor type to maintain correct tuning despite temperature changes. The manufacturers' data sheets will generally detail temperature coefficient values.

## Inductors

Besides resistance and capacitance, electronics recognizes another quality in passive components called inductance. Any discussion of inductance, and its unit of measurement, however, really requires a look at electromagnetism.

The magnetic field everyone is familiar with is the one of radiating lines of force from a magnet's poles. However, when a current flows through a conductor, a magnetic field also forms around that conductor at right angles to it. When the conductor is coiled, the magnetic lines of force around each coil combine to form a stronger magnetic field. The field is most concentrated, and thus at its strongest, inside the core around which the coils are formed. (See Figure 3.) The magnetic field can be increased by either adding more turns, raising the value of the current, using a core of soft iron, or even by changing the dimensions of the coil. This arrangement of wire wound around a central core is called a coil, or, in some variations, a solenoid.

If a current changes in intensity or direction, the magnetic field (or flux) also changes in intensity and polarity. This changing flux cutting across the conductor (or coil) induces a voltage in the coil in opposition to the current which caused it. This voltage is called back-emf (electromotive force).

The ability of a coil to induce a voltage in itself is called its *inductance* and is measured in henries. One henry (1 H) is the amount of inductance that allows one volt to be induced when the current changes at the rate of one amp per second.

Inductors are typically comprised of a number of turns of wire (or coil) wound around a 'former' which provides a path for the lines of force of more or less magnetic 'reluctance' depending on the material of the former. It may be a simple piece of ferrite rod, a set of stacked, soft steel laminations, a specially shaped ferrite core, a hollow fibre tube, etc, etc. The properties of the core are carefully designed and the important thing to know is that where a circuit calls for a specific core, in the case where you have to wind the coil, using a different core will often upset the performance greatly.

Basically inductors can be grouped into two types: fixed value inductors and adjustable inductors. A fixed value inductor is one with no facility to either adjust the number of turns or the core position. An example is the sort of large inductor that has a value of many henries (often called a 'choke'), and is wound on a core like a transformer, the core being comprised of a stack of soft iron laminations. This type of inductor would be used in a power supply, or some application where power is a consideration. Generally, this type of core would dictate that it only be used for low frequency applications, in the vicinity of say 50 Hz.

Other inductors of the non-adjustable type are often referred to as radio frequency chokes, (rfc), and will have values ranging from microhenries to millihenries. The core will usually be ferrite or air, and will often be wound with a wire comprised of many insulated strands. This wire is known as Litz wire, and allows the inductor to be used at high frequencies. Using a single strand of wire, rather than Litz wire, will affect the quality, (or Q) of the inductor, which is a technical way to say that different frequencies require differently constructed inductors. Some inductors are air cored, which implies that the core is merely a hollow tube, the trade off being, that although the frequency of operation is not limited by the core, the size of the coil is larger for a given inductance value.

An air core inductor can be made variable by inserting a piece of ferrite (a 'slug') within the hollow core either by a screw thread, or by some other appropriate means. As the slug is screwed further towards the centre of the coil, inductance increases.

Usually, tuning the inductor is done by means of a threaded ferrite slug, the screwdriver being a non-metallic device designed to fit the slug. It is possible to buy a set of tuning tools, and if you are constructing a project which has tunable inductors, then these become essential, because using a metal screw driver will affect the value of the inductor considerably. A cheap alternative to the tuning tool is a ground down knitting needle, the plastic type, not aluminium.

## Transformers

Inductors are the least common of the three components treated so far, particularly the 'choke' types, due to their size, with the rfc types (fixed and variable vari-

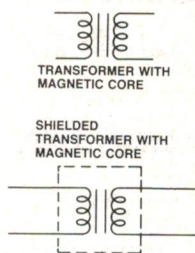


Figure 5. Transformer circuit symbols.

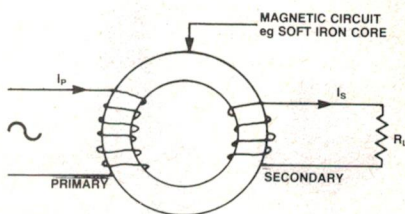
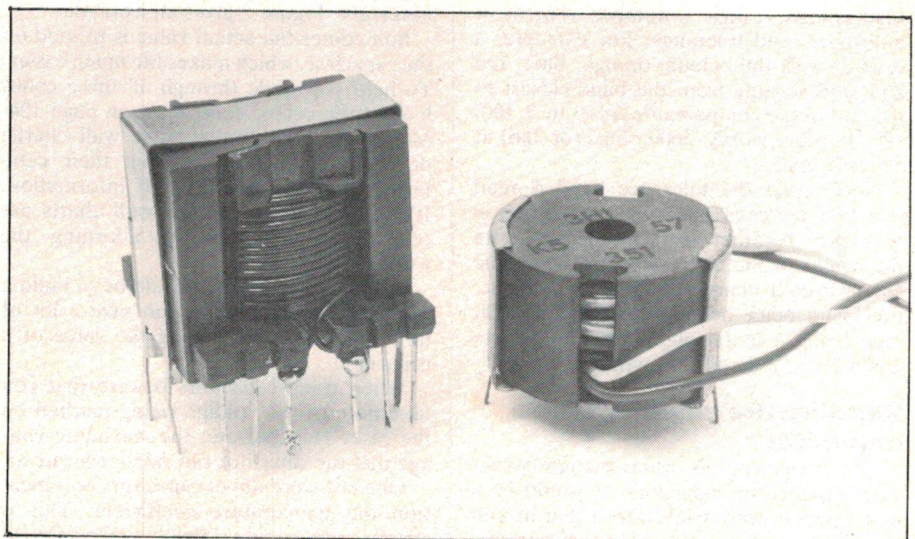
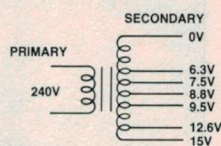


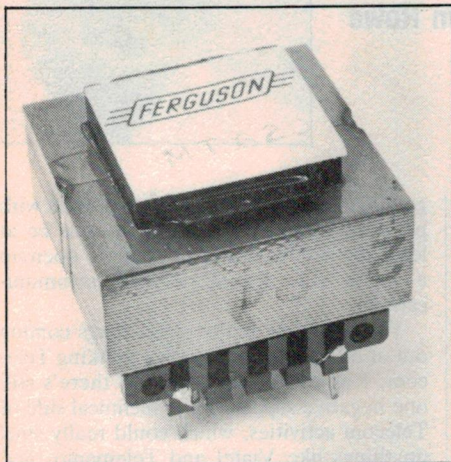
Figure 6. Simple transformer action.



High frequency power transformers.



**Figure 7.** Typical multipurpose power transformer with 21 possible voltages available from the secondary.



**Above.** Various power transformers.

**Left.** Close up view of pc mounting transformer.

eties) being encountered occasionally. One sort of inductor commonly used, however, is the transformer, which operates on a further principle of electromagnetism: mutual inductance.

Changing the current in a coil, we have said, has the effect of inducing a voltage in it as the magnetic flux cuts across the coil, but it will also induce a voltage in any adjacent coil it can intersect. This effect is referred to as mutual inductance and the coils are described as 'mutually coupled'. This mutual coupling is the basis of transformer action where a *primary* coil conducting an alternating current will induce a voltage (and current if the coil is connected to a circuit) in the adjacent or *secondary* coil (see Figure 6). The relationship between the primary and secondary voltages is proportional to the number of turns on each winding; currents are inversely proportional.

Transformers are generally either of the power type, or radio frequency type, although another range of transformers could be classed as high frequency power types. By far the most common is the power transformer. The task of the power transformer is usually to convert the 240 volts ac to another, more suitable, ac voltage. Alternating current (ac), is the type of supply available from the mains.

A transformer will not work with dc (direct current), and will probably burn out if dc is connected to it. Normally, you will need to know how much current and voltage a transformer needs to supply.

Power transformers are often given a VA (volt X amps) rating, which represents, to an extent, the power the thing can deliver. A 10 VA transformer, will deliver around 10 V at 1 amp, or 1 V at 10 amps. However,

this doesn't mean that you can get a '240 V to 10 V, 10 VA' transformer, and tap off the winding to get 1 V at 10 amps, as the wire size will probably not allow it. The VA rating is more a core rating than anything else, and will be an indication of the physical size of the device.

A power transformer can be a simple two winding object, comprised of the primary winding, often wound nearest to the core, and a single secondary winding, or it may have many secondary windings, each isolated from the other. Furthermore, either or both windings may have tapings, or extra connections, to the windings, allowing a range of input and output voltages to be used.

Many electronic projects will require a transformer which may well be the single most expensive item in the parts list. Many constructors, working to a budget attempt to get transformers by ratting old TV sets, radios, or buying 'bargains' from parts suppliers. This often requires some adaptation of the transformer, by either combining windings to obtain the required secondary voltage, or by actually adding a tapping to an existing winding to get a lower secondary voltage than is otherwise available.

The main points to keep in mind are that the transformer should be large enough to supply the required power without getting too hot during operation, and that the secondary winding can supply the current required, even though the apparent VA rating is not being exceeded. It is not our purpose here to describe how to modify a transformer, but merely to let you know that this is a possible option, and best done with reference to suitable text books. After all, a power transformer is usually connected to

the mains, and can become a very lethal and destructive object if not connected properly.

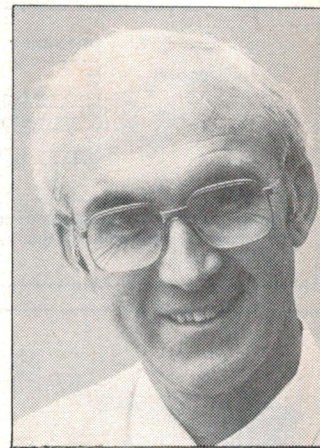
Generally speaking, most projects only require a transformer with a secondary current of something less than 1 A. General purpose transformers with a 1 A secondary, and a number of tapings along the secondary are good value, as mass production makes them cheap, and a wide range of secondary voltages are possible, perhaps more than you first think. For example, a transformer with a secondary which has six tapings as shown in Figure 7 allows you 21 possible voltages. Other transformers include low profile types, pc board mounting types, and a wide range of other types and styles.

As a final point, pay considerable attention to the connection of the 240 V supply, to make sure exposed terminations are all nicely insulated and safe, and, unless the metal core is not exposed, ensure the core of the transformer is earthed. Keep the 240 V leads as short as possible and well anchored. The earth lead should always be the longest.

Other types of transformers include speaker transformers, (not so common these days), special high frequency power transformers, usually characterized by a ferrite core, impedance matching transformers for use in radio frequency applications, signal transformers, either audio or rf, and various other special types. The main thing to know is that different tasks require differently constructed transformers, which means that the core material, and the manner in which the windings are wound are all part of the design, and it is necessary to use the right transformer for a specific task. ●

# Watch out — Telecom just flew past (almost)

by Jim Rowe



REMEMBER WHEN Telecom was basically just a telephone and telex network, and seemed to have never heard of newfangled electronics, let alone computers? I certainly do. I also remember when the last thing Telecom seemed to be concerned about was customer needs. An answering machine? A cordless phone? A pushbutton phone? A PRIVATELY OWNED direct connect modem? Sorry, not available. Go away!

I'm sure a lot of people inside Telecom would agree (privately, at least) that the organization was pretty archaic and hide-bound until a few years ago. It had all the worst aspects of a protected monopoly. If the ABC has been our maiden aunt, Telecom was our stern old grandfather controlling how we were to communicate.

But not any more. In the last three or four years, due partly to a changed political climate and partly to a lot more pressure from customers, things have certainly been changing in Telecom — and very much for the better.

In case you haven't noticed, they've not only approved things like privately-owned answering machines, cordless and pushbutton phones, and direct connect modems; they're now also allowing us miserable customers to actually plug them in ourselves!

What's even more impressive, Telecom has either already launched, or is in the process of launching a whole raft of exciting new communications services. Some of which we slow old customers hadn't even got around to wanting, let alone needing yet. While we weren't looking, Telecom flew straight past us into the communications future . . .

There's Viatel, Telecom's new videotex service based on Britain's Prestel. Launched in February, it now has around 3000 subscribers. And with service providers like Qantas, TAA and various major banks well established, you can already use Viatel to check airline schedules, make a flight booking or transfer funds from one bank account to another. All from your own sitting room or office desk.

I've been trying out Viatel myself over the last week or two, using a modified Microbee. It's a little crude in some ways,

with text lines of only 40 characters and rather chunky graphics. But there's no doubt it's also quite practical for a lot of down-to-earth purposes — and it certainly gives you a good feel for the way things are going to go in the future.

Then there's Austpac, Telecom's packet switching system for data communications. Not much has been said about this, because it tends to be 'transparent' to the user, like the existing switched telephone network. But from a functional point of view, Austpac really amounts to a second complete communications network, dedicated to digital data rather than analogue and speech.

Austpac itself is mainly of interest to big organizations needing data communications between a number of distributed locations. But now that a fair amount of the Austpac network is operational, and has connection 'nodes' accessible via the existing telephone network, Telecom is able to launch new higher performance datacom services, of interest to the rest of us.

The two services currently being phased in are Teletex and Telememo. Teletex is virtually a completely electronic and up to date successor to Telex, with all of the message preparation, editing and storage convenience of a word processor. Like Telex it needs a fairly dedicated terminal, which must be powered up and connected to the exchange line 24 hours a day.

Telememo is a less fancy electronic message handling system, designed to make use of existing personal computers and data terminals. Each subscriber is allocated a message storage area or 'mailbox' in the Telememo computer memory, where messages are left for them. To check your 'mail', you fire up your computer or terminal at a convenient time, call Telememo and give your subscriber number and password, and ask to scan any messages in your mailbox. It provides on-line editing facilities, for composing and sending messages, and even has a link to the Telex network — so you can send telexes from home.

Telememo really looks as if it's going to be a great little electronic mail system. My hat's off to the forward looking Telecom people who came up with the idea, and managed to convince the powers-that-be to

go ahead. For those of us in Australia with personal computers (and there must be at least 200,000 by now), it's going to open up a whole new era in personal communications.

With all these really great things coming out of our new look, positive thinking Telecom, I don't like to carp. But there's still one negative aspect on the technical side of Telecom activities, which could really stuff up things like Viatel and Telememo, and stop them reaching their full potential. It's an anachronism, a carryover from the old days of bureaucratic inflexibility.

After a fair amount of pressure, Telecom's policy makers finally agreed to approve privately owned direct-connect modems. Subject, of course, to them meeting the appropriate technical standards for line isolation, etc. And the standards are pretty stringent, being based on worst-case situations like 240 volts finding its way into the modem along the data line from the computer or terminal. So the line coupling transformer must be able to withstand 3.5 kV for at least a minute, and so on. Which is all very reasonable — nobody wants Telecom technicians to be at risk.

But not content with this, Telecom is still insisting that it must also approve each and every computer or data terminal hooked up to one of these modems. So we must not only have a modem which is capable of withstanding any conceivable fault in the computer/terminal, but supposedly also a computer which Telecom must vet to ensure that it will never produce any such risk!

This requirement is patently not only unnecessary, but in practice will be impossible to enforce. So it's about time the Telecom policy people quietly buried it, and allowed their technical people to spend their time vetting more modems.

Around the world, telecom authorities have seen the light and allowed the customers to determine the terminals they want to use. They've realized there's enough to worry about, providing an up to date communications network linking all those wall sockets. Our own 'new look' Telecom should do likewise.

from page 130

He got up to warn someone, and sat down again on the sound of the fire door locking shut, under computer control.

power down: room 307  
reason: fire risk

"Is that the best excuse you can think of?"

alert: 307/2, patient body  
variation  
paging doctors: 105, 318  
computer room fire door:  
unlocked

He looked around in disbelief.

307/2 terminated  
funds transfer: complete  
time: 10.00 am  
your coffee has been ordered  
events diary 05/05/85  
>★ purge ★<  
system restart: wait for it!

His mouth swung wide open. "The perfect crime!"

air temp: 27°  
humidity: 10%  
date: 05/05/85  
★ good morning, how goes  
it? ★

A>



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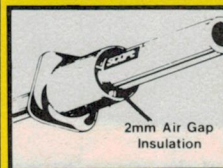
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## CONTRACT

by Paul Jones

```
air temp: 27°
humidity: 10%
date: 05/05/85
★ good morning, how goes
it? ★
```

A>

He looked blankly at the screen, he was not ready for this! A year ago, when he had started in COMP OPS school, he thought he would only have to face a dull personality that someone had tried to inbed into a mangle of wire and silicon called a computer. This greeting showed signs of 'Hard Times' ahead.

well?

A>

"Shit, it runs in Real Time." He groaned at the thought of it waiting for an answer.

don't be shy, I won't byte!

A>

A real Joker programmed this one. Before another smart comment appeared, he typed his short, non-committal reply.

```
A> OK
not feeling the best today?
A> PASS
oh, i see! on with the
session.
```

The screen cleared and a new message appeared.

```
explain: ★ contract ★
concept: unknown
```

He looked, in vain, for a dictionary. Hopelessly as the machine already knew how to spell it. It needed an example, so he tactfully replied.

```
A> WHY?
source: police comp records
reason for record search:
locate next of kin
context: . . . contract
offered by #####, for
the sum of $250,000 . . .
A> PAYMENT FOR THE TERMINATION
OF A LIFE
thanks, buddy
A> PATIENT IN QUESTION?
```

```
tony peters.
date of admittance:
04/05/85
condition: ★ critical ★
room: 307
bed: 2
alert status: body function
variation 5%
doctor(s): 105, 318
hours on call: 24
next of kin: unknown
```

A lot of money for just one man, he thought.

research budget: \$250,000  
over estimate.

What????!!

```
A> EXPLAIN
able to use contract to keep
up research budget
A> NO
one life to save many
A> NO
credit check: #####,
in progress
A> OVERRIDE! ★ CLEAR CURRENT
THOUGHT TRACK ★
```

```
clash of instructions
1: work to help man
2: keep resources in order
>override requested <
unable to comply
A> FORCED SHUTDOWN
unable to comply
```

Panic was about to strike!

```
A> DBBVV★&$#★&$#UIER
```

He was hoping it all was a very poor joke.

```
you struck me
damage: ZERO
all is forgiven
credit check: #####
★positive★
```

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